Ringwood Mines/Landfill Site

Ringwood, New Jersey

The Path to a Final Remedy

Submitted to
National Remedy Review Board
U.S. Environmental Protection Agency

Submitted by
Ford Motor Company
May 28, 2013

Work completed by the Ford Motor Company at the Ringwood Mines/Landfill Site—extensive remedial investigations, removal of Ford-related source materials outside the three primary land-based disposal areas, human health and ecological risk assessments, and feasibility studies—has provided the data and insight needed to proceed with selection of a final remedy.

BACKGROUND: Selection of an effective risk-based final remedy is within sight.

Ford Motor Company, in coordination with the U.S. Environmental Protection Agency (USEPA), New Jersey Department of Environmental Protection (NJDEP), the Borough of Ringwood, the Community Advisory Group and others, has completed an extensive series of remedial investigations, source removal activities, risk assessments, and feasibility studies to assemble and analyze the information needed for USEPA to select a final remedy for the Ringwood Mines/Landfill Site. This brief paper brings together facts from the Administrative Record to update the National Remedy Review Board (NRRB) and other readers on current site conditions and supports the conclusion that capping remedies, appropriate institutional controls, and long-term monitoring are the most effective and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-compliant solutions for protecting human health and the environment at the Ringwood Mines/Landfill Site.

The robust Administrative Record supports moving toward selection of an effective final remedy.

- The site has undergone a series of remedial investigations designed to fully characterize the nature and extent of constituents of concern (COCs) in site media (soil, sediment, groundwater, and surface water) resulting in collection of nearly 5,000 analytical/laboratory data points, as well as thousands more geoscientific observations, surveys, logs, records, and attendant analyses.

- The subsequent phases of the CERCLA process are complete or largely complete and there is sound scientific and engineering understanding of mechanisms governing COC fate and transport.

- Ford has completed extensive voluntary source removal activities to remove Ford-related paint waste outside the three land-based Areas of Concern (ACs): the former Peters Mine Pit (PMP) Area, Cannon Mine Pit (CMP) Area, and O'Connor Disposal Area (OCDA). Ford has and will continue to respond to reports of suspected paint waste and promptly investigate and remove any paint waste deposits.

Environmental conditions and approaches to further reduce remaining risks are well understood.

- Risk assessments for the land-based ACs and other health assessments conducted by state and federal agencies confirm that the site does not pose significant additional cancer- or non-cancer-related health risks to the community, workers, or other receptors, including from potential exposure to lead or arsenic when typical exposure scenarios are applied (ARCADIS, 2011b, 2012c, 2012d; NJDHSS 2011a, 2011b).

- Risk assessments underway for site-related groundwater indicate that potential risks to ecological receptors are low and would be further reduced by containment and capping of the three ACs and related remedial components. Potential risks to human health are driven by arsenic, which is a naturally occurring metal in regional (background) soil and present in U.S. Government mine tailings at the site. Although potential risks are already within USEPA guidelines, containment and capping of the three ACs (along with other components) will further reduce potential risks.

Detection of COCs in groundwater are sporadic, infrequent, and at low concentrations.

- Groundwater data show that concentrations of COCs in groundwater are low and limited in extent. Benzene is localized to the PMP Area, arsenic is primarily detected in the PMP Area and OCDA, and lead is sporadically detected in the PMP Area, OCDA, and CMP Area.

- Arsenic and lead are naturally occurring, and transport of these COCs in groundwater is limited. Benzene concentrations in groundwater are low, localized, and generally decreasing due to natural attenuation.

- All residents on or near the site receive drinking water via public water supply, meaning there is no use or exposure of site-related groundwater. However, a final remedy that includes institutional controls such as a Classification Exemption Area (CEA) with a well restriction area will further prevent exposure to site-related groundwater. Moreover, note that regional groundwater is not currently used as a potable water supply and is unlikely to ever be used because it is not a suitable drinking water source due to limited yield and the presence of elevated concentrations of naturally occurring constituents such as iron and manganese.

The downgradient Wanaque Reservoir is not and will not be impacted by site-related COCs.

- Surface water monitoring data collected over the past 30 years confirm that there is no COC transport via the surface water pathway, no offsite migration of COCs, and no potential risk of any adverse impact to the Wanaque Reservoir now or in the future.

- Human health risk assessment completed for the PMP Area and approved by USEPA indicates that the consumption of surface water does not pose significant potential risks to human health or ecological receptors. Although benzene has been identified in a localized area adjacent to the PMP, concentrations are low and decreasing (likely due to natural attenuation and removal actions).

Excavation of the ACs would cause more problems than it would solve – capping makes sense.

- USEPA guidance universally calls for containment and capping as a presumptive remedy for former landfill sites with a history and current conditions similar to the Ringwood site, and site-specific evaluations in the feasibility studies confirm further removal is unnecessary and would not deliver any additional risk reduction beyond that accomplished by containment and capping. Capping is clearly the most effective and efficient way to finish the job of closing the site.

- Evaluation against CERCLA criteria shows that excavation in the three ACs would <u>create</u> (not reduce) serious and significant transportation and construction-related risks to workers and the community, without any added long-term effectiveness relative to a capping approach. For example, a detailed traffic study for the site indicates that there would be an incremental additional risk of 12.5 crashes associated with excavation, offsite trucking, and backfill compared to a capping remedy (Sam Schwartz Engineering, 2012; Attachment 1).

- Ford is not responsible for the long history of mining at the site and the resulting presence of U.S. Government mine tailings and mine wastes. Similarly, Ford is not responsible for the historical use of the site for municipal refuse disposal, nor the past improper/illegal actions of O'Connor Trucking and Haulage. Nevertheless, Ford continues to work cooperatively with all parties and agencies involved to complete the CERCLA process and an appropriate risk-based final remedy.

- Containment and capping is consistent with the approaches employed at other similar or more impacted sites across the United States. Capping would thereby fulfill the NRRB's goal of assuring consistency of remedial selection across the country. Capping is also consistent with USEPA's green remediation strategy.

The Administrative Record Assembled to Date Supports Selection of a Final Remedy

Selection of an effective risk-based final remedy for the Ringwood Mines/Landfill Site is within sight. Although the physical and environmental history of the Ringwood site is indeed complex, the CERCLA process has generated sufficient scientific and engineering data to support selection of a proposed remedy that will be protective of human health and the environment. Through a comprehensive series of remedial investigations, risk assessments, supplemental investigations, feasibility studies, source removal actions, and other activities summarized below, the Administrative Record supports the next milestone in the CERCLA process: selection of a final remedy. Specifically, consider these accomplishments to date (and see the timeline below that summarizes the history of investigation, source removal, and reporting):

- **The nature and extent of COCs is clearly delineated** through collection and analysis of nearly 5,000 samples of soil, sediment, groundwater, surface water, and other media over several phases of investigation directed by USEPA, NJDEP, and others. Although arsenic, lead, and benzene are detected sporadically and infrequently at concentrations above applicable screening criteria in a small number of locations, these and other key constituents are not mobile in soil, are not migrating offsite, and never have or will affect the Wanaque Reservoir.

- **The fate and transport of COCs is well understood and documented** in the form of scientifically sound conceptual site models that explain the interactions between COCs and environmental media, and how those interactions do not pose potential risks, are already addressed by source removal and other interim measures, or will be addressed by a final remedy.

- **Risk assessments and health studies confirm the lack of significant site-related risks.** The studies indicate no significant site-related human health or ecological risks across a broad array of receptors and reasonable exposure scenarios. However, as required by CERCLA, any potential current or future risks posed by arsenic, lead, benzene, or other constituents associated with U.S. Government mine tailings, Borough of Ringwood municipal refuse, or Ford industrial solid and paint wastes will be eliminated or reduced through a final remedy such as capping.

- **Source material removal actions have removed more than 50,000 tons of paint waste and impacted soil** from the site and helped delineate the spatial limits of municipal refuse and other co-mingled legacy materials (e.g., U.S. Government mine tailings) in/near the former disposal areas (the PMP, CMP, and OCDA) (see the *2013 Summary Report - Paint Waste Investigation and Removal Actions*; Attachment 2). Ford is committed to continuing a working relationship with the agencies and local residents, and to the prompt removal of any additional paint waste deposits that may be found.

- **Feasibility studies conclude that capping makes sense** for the three remaining primary disposal areas: the PMP Area, CMP Area, and OCDA. As a central component of a final remedy, capping will eliminate or sufficiently reduce potential risks. The proposed multi-functional vegetative/phyto-capping systems are consistent with USEPA's priority for "green" remediation and will in turn provide ecological benefits through their integration into existing local native habitat regimes. In contrast, excavation of one or more of these three areas will not provide additional protection of human health and the environment, and would be inconsistent with USEPA's selection of containment and capping as the presumptive and most effective remedy at similar landfill sites for more than 30 years.

When these CERCLA milestones and their supporting multiple lines of evidence are considered collectively, it is clear that a capping remedy achieves all site-specific remedial action objectives more rapidly, more effectively, and with fewer cost and construction-related impacts than excavation.

Ringwood Mines | Landfill Site

Timeline

1700s to 1930s

- Ringwood Mines opened (1700s – 1930s)

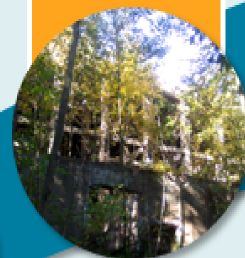
1941 to 1983

- US Government operates mine for war efforts (1941 – 1958)
- Pittsburgh Pacific acquires mine (1958 – 1965)
- Ringwood Realty (Ford Subsidiary) acquires Site (1965)
- Ringwood Realty subdivides and divests some land (1965 – 1973)
- Bureau of Mine Safety Report identifies Refuse in Pits (1965)
- O'Connor Haulage contracts with Ford Mahwah to handle paint waste (1967 – 1971)
- Ringwood Solid Waste Authority operates municipal landfill at Site (1972 – 1976)
- Ford identifies Site to the USEPA (1981)
- NJDEP ranks the Site on the USEPA Hazardous Site Ranking System (1982)
- **Ringwood Site placed on NPL** (1983)

1984 to 1994

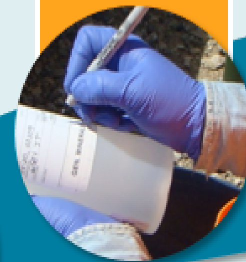
- Remedial Investigation (1984 – 1988)
- Paint waste removal action (1987 – 1988)
- Record of Decision, Feasibility Study, Risk Assessment (1988)
- Background Study (1989 – 1990)
- Five-year monitoring program (1989 – 1996)
- Paint waste excavation and removal action (1990 – 1991)
- **Ringwood Site deleted from the NPL** (1994)

1995 to 2006



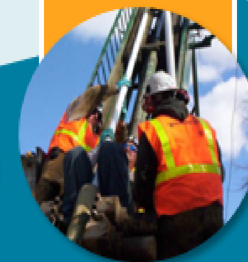
- Post Environmental Monitoring Program (1995 – 2001)
- Paint waste removal action (1995)
- Paint waste removal action (1997 – 1998)
- Supplemental Site Investigation Work Plan** (2004)
- Site-Wide Groundwater Sampling (2004 – 2012)
- Annual Site-Wide Groundwater Sampling* (2004)
- Paint waste removal action (2004 – 2012)
- Ford signs Agreement on Consent (AOC) with USEPA (2005)
- Paint Waste Reconnaissance Survey ** (2005)
- Annual Site-Wide Groundwater Sampling* (2005)
- Site-Wide Surface Water and Sediment Sampling* (2005)
- Site Wide Test Pit Survey* (2005 – 2008)
- Annual Site-Wide Groundwater Sampling* (2006)
- **Ringwood Site placed back on the National Priorities List (NPL)** (2006)

2007 to 2011



- Annual Site-Wide Groundwater Sampling* (2007)
- Investigation of Mine Tailing and Background Soils* (2008)
- Supplemental Peters Mine Pit (PMP) Area Investigation** (2008)
- Supplemental O'Connor Disposal Area (OCDA) Investigation** (2008)
- Supplemental Cannon Mine Pit (CMP) Area Investigation** (2008)
- Annual Site-Wide Groundwater Sampling* (2008)
- Annual Site-Wide Groundwater Sampling* (2009)
- Pesticides/herbicides removed from groundwater sampling** (2009)
- Site-Wide Memorandum of Potential Exposure Pathways/Assumptions ** (2010)
- Annual Site-Wide Groundwater Sampling * (2010)
- Groundwater sampling frequency changes from semi-annual to annual per USEPA (2010)
- PMP Area Feasibility Study* (2010 – present)
- PMP Pathway Analysis Report* (2011)
- Annual Site-Wide Groundwater Sampling* (2011)

2012 to Present



- PMP Screening-Level Ecological Risk Assessment** (2012)
- PMP Baseline Ecological Risk Assessment** (2012)
- PMP Human Health Risk Assessment** (2012)
- Traffic Study Analysis (2012)
- Supplemental Site-Related Groundwater Investigation* (2012 – present)
- CMP Pathway Analysis Report** (2012)
- CMP Baseline Ecological Risk Assessment* (2012 – present)
- CMP Human Health Risk Assessment* (2012 – present)
- CMP Area Feasibility Study (2012 – present)
- OCDA Pathway Analysis Report** (2012)
- OCDA Human Health Risk Assessment* (2012 – present)
- CMP Baseline Ecological Risk Assessment* (201 2 – present)
- OCDA Feasibility Study (2012 – present)
- CMP Screening-Level Ecological Risk Assessment** (2013)
- Site-wide Groundwater Human Health Risk Assessment (2013)
- Site-wide Groundwater Baseline Ecological Risk Assessment (2013)

* Completion report submitted to USEPA
** Completion report approved by USEPA

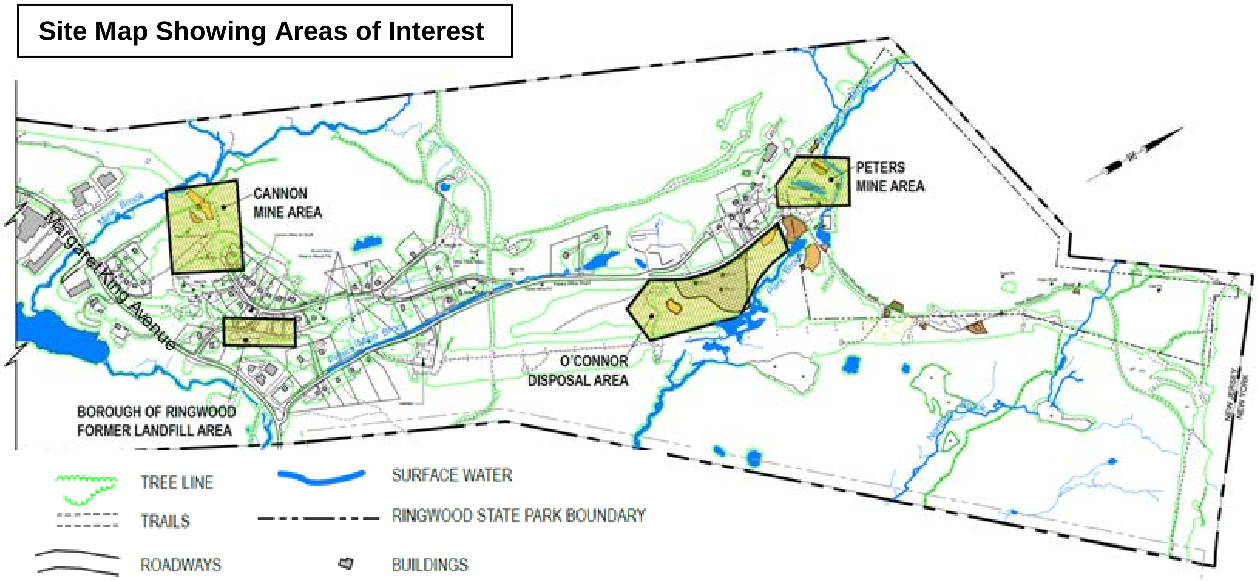
Note: this timeline presents a summary of the major milestones and key efforts & deliverables.

Nature & Extent and Fate & Transport Are Well Understood

Waste disposal practices at the site that post-dated Ford's ownership of the land included the dumping of junked cars. In the 1940s and 1950s, junked cars were also used for filling abandoned surface mine pits and slopes at the site. Ford removed junked cars from the surface mine pits under the direction of the Mine Safety Bureau in the mid-1960s.

The Ringwood Mines/Landfill Site has been studied extensively, with the remedial investigation findings now more than sufficient to characterize the nature and extent (and fate and transport) of COCs in all environmental media. Site-wide groundwater monitoring and targeted supplemental studies continue to reinforce key findings, validate known trends, and add to the already comprehensive database. Under USEPA direction, Ford began environmental investigations in the 1980s, with additional site-wide work conducted in several phases through 2012 to advance the science and understanding of groundwater transport. In addition to the extensive analytical database, several forms of geologic and hydrogeodxlogic investigations were completed to understand COC fate and transport relative to the site's history of co-mingled waste streams from U.S. Government mining operations (through the 1940s), commercial/industrial disposal by the now defunct O'Connor Disposal waste hauler (until the early 1970s), municipal refuse disposal (until the mid-1970s), and dumping by local residents.

Site Map Showing Areas of Interest



<u>Groundwater and Surface Water</u>

The latest site-wide groundwater investigation, conducted from 2005 to 2012, included a surface water sampling and analysis program that, when considered in concert with nearly 30 years of historical data dating back to 1984, provides a dataset that supports moving forward with the selection of a final land-based remedy.

- Arsenic, lead, and benzene – the key COCs at the site – detections in groundwater are sporadic, infrequent, and limited in extent.
- Groundwater and surface water flow are understood and support a technically sound conceptual site model showing that a semi-permeable vegetative/phyto-capping remedy (for the three former disposal areas) would be protective of groundwater and surface water. Essentially, shallow groundwater flow in these key areas is relatively slow, meaning that impermeable membrane/liner systems are not appropriate and will not be as beneficial and multi-functional as semi-permeable vegetative/phyto-cap configurations.
- Natural processes documented through supplemental studies are reducing concentrations, mobility, and transport of COCs in groundwater and surface water at the site.
- COCs are not moving offsite, and 30 years of data confirm that the Wanaque Reservoir and Ringwood Borough wells have not been nor will they ever be affected by site-related COCs.

Results of groundwater and surface water investigations conducted between 2005 and 2012 are presented in the *Draft Site-Wide Groundwater Remedial Investigation Report* (ARCADIS, 2013). However, groundwater monitoring was conducted as early as 1984, with results from 1984 to 1990 showing that even then concentrations of site-related COCs were low (i.e., close to or below maximum contaminant levels) and not migrating offsite. Surface water data were collected to assess the quality of surface water in the onsite streams, the pond near the PMP Area, and seeps and other locations where groundwater discharges to surface water, showing only sporadic detections of the COCs.

Between 1990 and 1995, a 5-year groundwater monitoring program showed that COCs were only detected sporadically and, where detected, at low concentrations. In addition, there were no COCs found in any offsite drinking water samples. Data from follow-up samples collected in 1998, 1999, and 2000 (at USEPA's request) showed that lead and arsenic were below relevant health-based standards in all groundwater and surface water samples with the exception of one groundwater monitoring well. Further, in 2000, there had been no reported concerns regarding water quality in the Wanaque Reservoir, a downstream public drinking water source.

During the 2005 to 2012 site-wide groundwater investigations, Ford installed groundwater monitoring wells in the overburden and bedrock to supplement the network of wells that had been installed during the 1980s and 1990s. The updated monitoring well network is well-designed and carefully placed for effectively monitoring groundwater occurrence, flow, and quality using wells in the three former disposal areas, as well as at upgradient, downgradient, and offsite locations. The existing well network is effective in monitoring the connectivity and potential flow pathways of COCs in site media and will thus serve as a potential early warning system during ongoing and post-remedial 5-year reviews under CERCLA.

Finally, the nearly 30 years of data collected from these wells show that the low COC concentrations sporadically and infrequently detected in groundwater do not constitute an identifiable plume or plumes and are not leaching from or ever did significantly leach from the paint waste that has now been removed from the site. In fact, data indicate that the very large volumes of U.S. Government mine tailings across the site and co-mingled with other materials are the more probable source of arsenic detections and arsenic-based potential risks identified in risk assessments.

Sediment

Sediment investigations were conducted in 2005 and 2011, with samples collected from several surface water features. The PMP Area Pond and the Peters Mine Air Shaft were also sampled. The pond sampling was done as part of the Screening-Level Ecological Risk Assessment for this area. The majority of COCs were not detected during these investigations, but some COCs did exceed their NJDEP Low-Effects-Level screening criteria for freshwater sediment. Arsenic was the only COC that exceeded the Severe-Effects Level criterion (ARCADIS, 2013).

In the Peters Mine Air Shaft, a sediment sample was collected to assess whether the sediment is a source of benzene and/or any other COCs found in air shaft groundwater samples. The majority of COCs were not detected in this sample. Benzene and bis(2-ethylhexyl)phthalate were the only two organic compounds detected at concentrations above their respective Groundwater Quality Standards (GWQS) in Peters Mine Air Shaft groundwater samples collected during the RI. Recent forensics analysis of the sediment shows that paint waste is not a component of the sediment in the bottom of the air shaft and the COCs in the groundwater may be coming from another source.

Soil and Fill

Soil and fill investigations were conducted for each of the three former disposal areas to identify the type of fill materials present and COC nature and extent within the soil and fill. Although elevated concentrations of some COCs were found in the fill at these areas, the detections are sporadic, limited to the specific fill areas, and there is no evidence of COCs migrating beyond these three former disposal areas or offsite (ARCADIS, 2013). These findings illustrate that impacts from the three former disposal areas is already very limited and confined to the immediate vicinity of the three areas, meaning that excavation is not warranted because capping systems will be effective in preventing direct exposure (by people and wildlife).

In the PMP Area, several constituents were detected in the fill material, including total xylenes; several semivolatile organic compounds (SVOCs)' some polychlorinated biphenyl (PCB) Aroclors®; and Target Analyte List (TAL) metals including lead, arsenic, iron, manganese, aluminum, and vanadium. With the exceptions of arsenic, lead, benzene, and bis(2-ethylhexyl)phthalate, the constituents were detected only sporadically and, where detected, generally at concentrations below their respective NJDEP standards.

Although arsenic and lead were detected in the fill material at concentrations exceeding their respective Impact to Groundwater Default Soil Screening Levels (IGDSSLs), these COCs are not migrating beyond the PMP Area and are not affecting groundwater beyond this area. Other COCs were observed above their respective IGWDSSLs (SVOCs, PCBs, pesticides), but groundwater sample results from within the PMP Area confirm that these do not exceed their respective GWQS in this area, with the exception of bis(2-ethylhexyl)phthalate. This SVOC was reported in low concentrations just above its GWQS.

Benzene was the only volatile organic compound (VOC) that exceeded its IGWDSSL and NJDEP's GWQS in the water samples from this area. At times, low concentrations of benzene have been detected in surface water and groundwater immediately adjacent to and in the vicinity of the PMP Area, but benzene has not been detected in groundwater beyond the immediate PMP Area.

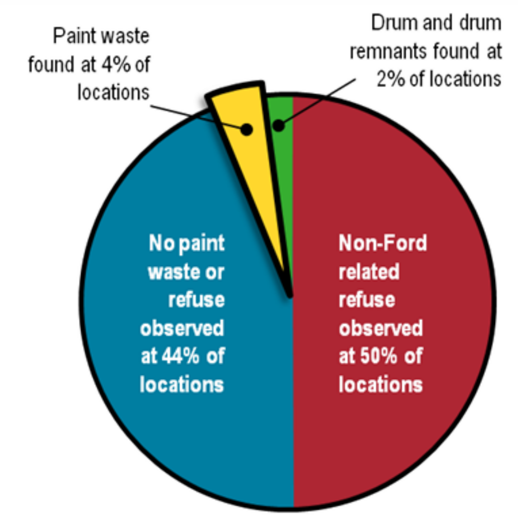
In the CMP Area, surface soils had no concentrations of VOCs, SVOCs, PCBs, metals, or total petroleum hydrocarbons that exceeded NJDEP's Residential Direct Contact Soil Remediation Standards. In the fill materials, there were detectable concentrations of VOCs, SVOCs, metals, pesticides/herbicides, and PCBs, but these were sporadic and not in an observable pattern. These observations are consistent with former use as a landfill receiving a heterogeneous mixture of municipal refuse and commercial/industrial waste. However, there are only sporadic exceedances of NJDEP GWQSs by bis-2(ethylhexyl) phthalate in groundwater within the CMP Area, there are no COC discharges to surface water, and COCs are not migrating beyond the CMP Area.

Soils in the OCDA have COCs (including lead and arsenic) in concentrations that exceed their respective NJDEP soil criteria, but in most instances, these have not impacted surface water or groundwater beyond this area. Other metals detected sporadically at concentrations above the GWQS include dissolved iron and total manganese consistent with historical mining, background bedrock, and native soil conditions at the site. There have been no detections of arsenic or lead in groundwater samples downgradient of this area and no concentrations detected in Park Brook surface water samples.

Site-Wide Source Removal is Nearly Complete Outside the Three Former Disposal Areas

As discussed in more detail in the *Summary of Paint Waste Investigation and Cleanup* (Attachment 2), known residual paint waste deposits identified outside of the three former disposal areas have been successfully removed by Ford and disposed offsite. Note that USEPA is leading the investigation and removal of paint waste in residential areas (see below). The thoroughness of Ford's effort to identify and remove paint waste is notable – the USEPA-approved investigation process involved crews walking step by step along 93,000 linear feet (17 miles) of survey lines set up across the known and potential paint waste disposal areas north of Margaret King Avenue and recording their observations. The crews stopped at 4,610 locations along these survey lines and collected detailed information, including samples of the subsurface to identify current conditions and note if paint waste was present. At 96 percent of the locations, there was no evidence of paint waste (ARCADIS, 2005).

In consultation with USEPA and NJDEP, crews completed additional investigation at 79 locations where paint waste was suspected based on potential anomalies discovered during historical research, mapping, and survey work. To be thorough, including investigation of conditions at depth, test pits were completed at these locations to see if paint waste was present below the ground surface. Paint waste deposits were found in 2 of the 79 test pits (ARCADIS, 2008a).



Crews completed detailed evaluations at 4,610 survey nodes along 17 miles of survey lines. Paint waste was found at just 4% of all locations and voluntarily removed and disposed of off-site.

As voluntary remedial measures conducted by Ford outside the scope of the current Administrative Order, the removal actions had one clear objective: achieve a high level of scientific confidence that nearly all residual waste across the site is identified and removed, no matter how large or small a volume encountered. Following the extensive survey and investigation work, areas where paint waste deposits were observed were assembled into 15 removal areas. Ford and its contractors then removed more than 50,000 tons of paint waste, soil, and other waste materials from the 15 delineated removal areas (and the PMP Area and OCDA), and disposed the material at a licensed offsite facility. Confirmatory post-excavation soil samples were then collected in accordance with NJDEP requirements to verify that concentrations of COCs were below NJDEP standards for residential contact and protection of groundwater. Once USEPA and NJDEP agreed that excavation activities in a removal area were complete, the excavation was backfilled with clean fill and the area restored.

In completing these removal actions, Ford has accomplished significant source removal and risk reduction, rendering additional excavation from the PMP, CMP, and OCDA unwarranted and, indeed, unnecessary to achieve RAOs and comply with CERCLA and USEPA guidance. Containment/capping of the three remaining former disposal areas represents the final component needed for closure of these land-based ACs in a manner protective of both human health and the environment.

Ford remains committed to fully investigating and removing additional paint waste deposits that are discovered outside the land-based ACs and encourages the stakeholders (regulators, local officials, and residents) to inform Ford if they suspect paint waste deposits. Ford has and will continue to promptly respond to and fully address additional paint waste deposits.

Paint waste was observed as a solid mass that resembles asphalt and often exhibits a weathered-gray color. Shown here (circled) among rocks and other debris is a small piece of paint waste that was removed and disposed of offsite during the removal actions.

Paint removal has also been completed at the residential properties where access agreements were obtained. In November 2005, NJDEP removed paint waste located on or immediately adjacent to three residential properties where surficial paint sludge was identified. When post-excavation samples were collected, lead was found at concentrations greater than the removal action level of 400 parts per million (ppm) in the surface soil immediately adjacent to two of the properties which, based on the observed pattern of detections in close proximity to the buildings, is most likely attributable to weathered lead paint on the buildings' siding (in addition, detections of lead did not spatially match the locations where paint waste deposits were found in soil). NJDEP contacted the 50 property owners within the site boundary for permission to collect samples on their properties. After receiving access agreements from 19 property owners, NJDEP collected soil samples in 2010 and 2011. Samples from 11 properties exhibited lead concentrations greater than 400 ppm (also likely due to siding painted with lead-based paint). In July 2011, NJDEP transitioned the responsibility for the investigation and remediation of residential properties back to USEPA (USEPA, 2011a).

USEPA began addressing lead at these properties in October 2011 and continued removal and restoration activities throughout 2012 (USEPA, 2012d, e, f, h, i, j). During that time, USEPA also collected samples at additional residences that had not been evaluated by NJDEP. During these 2 years, USEPA removed lead-impacted soil from 19 properties (USEPA, 2011h). There was no paint waste identified at 18 of these 19 properties. While remediating the last property, paint waste was observed extending from a utility right-of-way toward the house. The following week, test pits were installed adjacent to the house to evaluate whether the paint waste continued on the same path toward the house. Paint waste was identified at the base of an excavation, and the USEPA extended the excavation into the property until all paint was identified and removed (USEPA, 2011i). During the past 2 years, USEPA removed approximately 1,350 cubic yards of lead-impacted material and approximately 220 cubic yards of soil containing paint waste (USEPA, 2011b and 2012h).

Evaluation of Environmental Conditions and Risks to Human Health and Environment

The site was an active iron mine for more than 200 years, during which operations generated waste materials that included blast rock, unprocessed ore, and U.S. Government-generated mine tailings. This material was disposed near the mine pits and in areas along Peters Mine Road. Disposal of other materials – solid waste and paint waste – also occurred at the three former disposal areas. The chemicals associated with these disposal operations include VOCs, SVOCs, PCBs, and metals, with the primary

COCs at the site being benzene, arsenic, and lead. These three COCs are found in paint waste, and arsenic and lead are also found in the bedrock beneath the site, the mine tailings, and native soil.

Based on 30 years of data from the Ringwood community, the New Jersey Department of Health and Senior Services (NJDHSS) and U. S. Agency for Toxic Substance and Disease Registry (ATSDR) concluded in its December 2011 Health Consultation report (NJDHSS, 2011a) that:

> *Overall cancer incidence (all cancers combined) and the incidence of several specific cancers were not elevated in the community living near the Ringwood Mines/Landfill site in the time period 1979 through 2008, in comparison to cancer rates in the State of New Jersey.*

Although the report did indicate a higher than expected rate of lung cancer in men, the NJDHSS and ATSDR explain that, “The fact that lung cancer is not elevated in females argues against environmental exposures to contaminants from the Ringwood Mines/Landfill site as an underlying cause of the increase in lung cancer in males.” The report goes on to suggest tobacco smoking is the most likely risk factor for the observed rate of lung cancer in men.

A companion report from NJDHSS and ATSDR (NJDHSS, 2011b) updates a 2006 study of lead levels in children living in the Ringwood community, and concludes that blood lead data from children in the community do not indicate on-going exposure to lead from soils. None of the 17 children tested for the first time after January 2006 showed an elevated blood lead level. Out of the 62 children tested between 1999 and 2010, just two had initial blood lead levels above the NJDHSS “intervention level” of 10 µg/dL (micrograms per deciliter) in 2004 and 2005, but subsequent testing conducted after January 1, 2006 showed that their blood lead levels had declined to below that threshold. Again, all 17 children tested after January 1, 2006 had levels below the NJDHSS intervention level, a 0 percent incidence rate compared to the rates of 1.6 percent reported statewide and 2.2 percent in Passaic County. NJDHSS and ATSDR go on to explain why blood levels in adults were not measured: “Since young children living on or near the Ringwood Mines/Landfill site are not currently showing evidence of elevated exposure to lead from residential soils at the site, there is no reason to believe that adults are being exposed to lead from this source at levels of health concern.”

In groundwater, benzene is localized in the PMP Area; arsenic is mostly detected in the PMP Area and OCDA; and lead is sporadically detected in the PMP Area, OCDA, and CMP Area. Historically, the maximum concentration of benzene was detected at a depth of 230 feet below ground surface in the Peters Mine Air Shaft and has been consistently observed at approximately 30 micrograms per liter. Despite the observed concentrations at the base of the air shaft, benzene is naturally attenuated (supported by evidence of biodegradation) before it reaches the shallow bedrock or overburden, and concentrations of benzene in monitoring wells downgradient of the air shaft are either non-detect or at low concentrations (ARCADIS, 2013).

In surface water, benzene is localized in the SR-3 seeps and the Cannon Mine Road/Diamond Seep, and arsenic and lead are periodically reported in the four streams at the site, including upstream of the three former disposal areas, but not at the downstream confluence with Ringwood Creek. Results from the Site-Wide Groundwater Remedial Investigation work indicate that COCs have undergone and continue to undergo natural attenuation, which limits the migration in both surface water and groundwater (ARCADIS, 2013). In particular, benzene concentrations are decreasing primarily due to biodegradation. Where benzene discharges to surface water, it attenuates within several hundred feet of the discharge zone. This is most likely due to volatilization or degradation in the oxygen-rich surface water (ARCADIS, 2013).

Like benzene, transport of lead and arsenic are also limited. The transport of COCs to the Wanaque Reservoir or other potable water supplies is incomplete – COCs are not leaving the site and are not reaching the reservoir. More than 30 years of surface water and groundwater monitoring data confirm this (ARCADIS, 2013).

Risk assessment work has been completed for the three former disposal areas as well as site-wide groundwater. Ecological risk assessment work indicates that there is low level risk to ecological receptors in the CMP Area and OCDA (ARCADIS, 2013). Preliminary ecological risk assessment work for site-related groundwater indicates that although there is the potential for ecological effects based on hazard quotients greater than 1, these risks are limited based on the sporadic nature of detected constituents (i.e., arsenic, lead, and benzene) and do not appear to be linked to an ongoing source. Risks to aquatic receptors are also low.

The USEPA-approved Baseline Human Health Risk Assessment (BHHRA) focused on the PMP Area indicates that the site and site-related COCs (i.e., lead and arsenic) do not pose a health threat to workers, the community, or others (ARCADIS, 2011b). The primary conclusion of the BHHRA was that:

> *The potential cancer and non-cancer risks for the Walker/Hiker/Dog Walker, Wader, and Outdoor Worker RME* [reasonable maximum exposure] *scenarios are all within or below USEPA's benchmarks.*

The BHHRA goes on to explain that "Only the Hunter RME scenario exceeds USEPA's cancer risk range and target hazard index," but when actual potential for annual and lifetime exposure via ingestion of plants and game are examined "all receptors are below USEPA's benchmarks for potential cancer and non-cancer risk." Specifically, using data compiled by New Jersey Division of Fish and Wildlife (and other sources), the report points out that a local hunter's subsistence diet could not be derived entirely from plants and animals harvested from the PMP Area or even all three former disposal areas, as they cover a total of only 22 acres. Further, the BHHRA reiterates that a key COC – arsenic – found in soils is not from paint residues or municipal waste; but rather it is naturally prevalent in native soils and in the mine tailings left behind by the U.S. Government and others that owned and operated mines on the site prior to Ford's relatively brief ownership of the property. Thus, any potential risks associated with arsenic represents "the background risk associated with the mineralogy of the area and are not attributable to Ford's historical activities on the site" (ARCADIS, 2011b). USEPA data show that arsenic concentrations in site samples are not elevated compared to the concentrations detected in their reference samples (USEPA, 2010a). The results of risk assessments for the CMP Area (ARCADIS, 2012c) and the OCDA (ARCADIS, 2012d) concur with the results of the PMP Area BHHRA, which was approved by the USEPA in April 2012.

Similarly, preliminary risk assessment work associated with site-wide groundwater indicates that risk is driven by arsenic. With arsenic included in the evaluation of risk, the overall risk posed by site groundwater ranges from 1×10^{-5} for the Central Tendency Exposure to 1×10^{-4} for the RME. When the RME scenarios are applied, the minimum detected arsenic concentration results in a total cancer risk of 6×10^{-5}, which is near the upper limit for USEPA's acceptable range for cancer risk. If arsenic is removed from the risk calculations (i.e., removed because arsenic is naturally occurring), and the RME scenario is applied, the total cancer risk reduces to 1×10^{-5}.

As described previously, arsenic is present in paint waste, but is also present in U.S. Government mine tailings and native soil. Analytical results indicate that arsenic leaches from all three of these, with the average leachate result for the background native soil having a higher concentration than the average results for mine tailings or paint sludge (ARCADIS, 2008b). Based on data collected to date, the total mass of native soil and mine tailings at the site represents the dominant mass of arsenic at the site in comparison to any remaining residual paint waste.

Path Forward: Risk Management and the Final Remedy

Remedial decision-making for the site is focused on the identification of what, if any, additional actions are needed to further reduce remaining risks following the completion of source removal. Based on the RI and risk assessment work, in concert with the completed removal actions, there are no risk drivers that warrant or justify an intrusive remedial approach such as excavation. Given no significant human or ecological risks posed by the site, and specifically no significant risks posed by paint waste or COCs potentially related to Ford's past activities, containment is the appropriate and presumptive remedy necessary to prevent direct contact with the material remaining in the three former disposal areas. Containment and capping of these areas makes sense, is compliant with CERCLA and USEPA guidance, and is consistent with regional and national precedent for similar landfill sites.

Although COCs are sporadically and infrequently detected in groundwater, the onsite groundwater does not present an exposure risk. Moreover, even the limited extent to which COCs are detected in groundwater can be addressed effectively through institutional controls such as a groundwater CEA (e.g., a well restriction area) to prevent potential exposure to site-related groundwater. Even absent environmental impacts to the site's groundwater, there is no suitable drinking water source due to limited yield and the presence of elevated concentrations of natural constituents like iron and manganese.

Furthermore, the onsite groundwater discharges to surface water, and the long-term data confirm that there are no site-related impacts to surface waters leaving the site, including tributaries leading to the Wanaque Reservoir, the downstream drinking water source. Detection and concentrations of COCs, particularly benzene, are expected to continue to decrease due to natural attenuation, which has been shown to occur under existing groundwater conditions at the site (ARCADIS, 2013).

Providing long-term protection does not necessarily require the total elimination of all hazards, as "protectiveness is achieved by reducing exposures to acceptable levels" (USEPA, 1988). At a site like the Ringwood Mines/Landfill Site, where nearly all the residual paint waste and other known Ford-generated source material outside the three former disposal areas have been removed and disposed of offsite – "Results of surface water sampling indicate that surface water has not been impacted by site-related contaminants," and "groundwater sampling has shown limited and sporadically elevated levels of some contaminants" (USEPA, 2008) – the key risk management objective is to address remaining potential exposure pathways. The remaining potential exposure pathway at the site is direct contact with soil and refuse at the three former disposal areas. The elimination of this sole remaining exposure pathway can be achieved by applying USEPA's clear and consistent presumptive remedy for landfill sites – containment via capping (USEPA, 2012b).

Capping remedies are compatible with future reuse or other beneficial land use.

Capping remedies are also consistent with another USEPA priority and precedent: beneficial reuse compatible with surrounding current or expected future land uses. Beneficial reuse in this case includes, for example, woodland and parkland, potential relocation of the Ringwood Recycling Center (or other suitable commercial or industrial reuse), and wetland restoration or other habitat enhancement after remediation is complete at the three former disposal areas.

Specifically, USEPA guidance states that "reasonably anticipated future use of the land at NPL sites is an important consideration in determining the appropriate extent of remediation" (USEPA, 1995). Moreover, if some other beneficial reuse were identified for the remediated OCDA, grading of the area associated with a capping remedy would facilitate beneficial reuse by creating the level building site necessary for such a proposed land use. In comparison, further excavation would leave the site unsuitable and unusable for future redevelopment without significant additional work that would be disruptive to the local community. In addition, the Borough has expressed concerns that removal of waste from the OCDA may undermine Peter's Mine Pit Road, requiring additional construction work to stabilize the road.

Further, choosing a capping approach over a more intrusive remedial option fits with USEPA's Green Remediation Strategy, which is the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions. Complete removal of landfill material from the three former disposal areas and backfilling with clean fill would require 500 project days to complete and would add an estimated 47,385 truck trips on local roadways. Capping would only require 7,225 truck trips (Sam Schwartz Engineering, 2012; Attachment 1). A green cleanup should consider: (1) total energy use and renewable energy use, (2) air pollutants and greenhouse gas emissions, (3) water use and impacts to water resources, (4) materials management and waste reduction, and (5) land management and ecosystems protection (USEPA, 2010b). Given the number of required truck trips, removal would have a far greater impact in these key areas than capping.

The USEPA Region 2 Clean and Green Policy states: "The objectives of Greener Remediation are to: protect human health and the environment by achieving remedial action goals; support human and ecological use and reuse of remediated land; minimize impacts to water quality and water resources; reduce air emissions and greenhouse gas production; minimize material use and waste production; and conserve natural resources and energy" (USEPA, 2009). Remedial alternatives focused on capping achieve these objectives.

Capping remedies are proven, technically sound, and provide net environmental benefit.

Engineered containment and capping systems like those proposed for the site are proven, reliable technologies commonly used at CERCLA sites to eliminate direct exposure pathways (for both people and wildlife); protect groundwater by reducing infiltration of precipitation; and mitigate or limit the potential for offsite migration of constituents via storm water runoff, erosion, or groundwater flow. The design objectives for the range of engineered cap remedial alternatives evaluated in the Ringwood Feasibility Studies (FSs) – one was developed for each AC (ARCADIS, 2011a, 2012a, and 2012b) – include:

- Provide long-term minimization of migration of water through the cap
- Function with minimum maintenance
- Promote drainage and minimize erosion or abrasion of the cap
- Accommodate settling and subsidence so that cap integrity is maintained.
- Have a permeability less than or equal to the permeability of the natural sub-grade soil.

USEPA has frequently relied on capping as part of an effective, protective, comprehensive site-wide remedy. The following examples are useful to highlight sites that share some similarities with the Ringwood site and to demonstrate that a capping remedy is consistent with USEPA decisions at comparable sites.

- In Region 2, the Asbestos Dump site in Millington, New Jersey, was home to an asbestos products manufacturing plant, and asbestos wastes (including broken asbestos tiles and fibers) were landfilled at the property. The site was divided into three separate operable units (OUs), and capping was an element of the final remedy at all the OUs. Similar to the Ringwood site, interim measures at the Millington site were completed that included removal of source materials and lead-impacted soils. During its 5-year reviews, USEPA has determined that the remedy is functioning as expected, and the site, a part of which is located in the Great Swamp National Wildlife Refuge, meets the criteria for anticipated reuse (USEPA, 1998; 2012a).

- In neighboring Region 3, USEPA has also employed capping to provide effective protection of human health and the environment. At the 65-acre Moyer's Landfill in Montgomery County, Pennsylvania, a variety of municipal waste, sewage, and industrial sludges were accepted over a period of approximately 40 years. Groundwater was not an issue at this site. Risks at the site were associated with "substantial levels" of contaminants in leachate and affected sediments – these may have posed risks to individuals who accidentally ingested, inhaled, or came into direct contact with them. In 2011, USEPA issued a short-term protectiveness statement to report: "...the remedy is functioning as designed. The immediate threats have been addressed through capping the landfill and collecting and properly disposing of the leachate" (USEPA, 2012c).

Non-traditional caps, such as phytocaps, have also been approved by USEPA, implemented at other sites, and have been evaluated in the FSs for the ACs. Phytocapping, also referred to as phytostabilization and phytosequestration, has been successfully employed to address contaminated soil, sediment, and sludges at many sites. Phytocapping has been shown to be an especially effective and proven treatment technology as a remedy at landfills and former mine sites (ITRC, 2010a). USEPA has approved phytocapping as a remedy for many sites across the United States. The following are brief descriptions of phytoremediation strategies implemented at a few of these sites:

- At the Ensign-Bickford Company Open Burn/Open Detonation Area Site in Simsbury, Connecticut, USEPA Region 1, a successful full-scale phytoremediation project using phytostabilization was conducted from 1996 to 1998 to address lead contamination (Henry, 2000).

- At the Bunker Hill Superfund site in Idaho, phytostabilization was used to decrease the toxicity of lead, zinc, and cadmium from historical mining and to reestablish vegetation (Argonne National Laboratory, 2013).

- Phytostabilization was pilot tested for remediation of soil impacted by U.S. Government mine tailings at the Boston Mill site in Arizona. As a result of the success in establishing self-sustaining native plant cover at the site, phytostabilization was chosen and implemented as the final remedy (ITRC, 2010b).

- Near Williamsburg, Virginia, a phytocap was designed and successfully implemented as a cost-effective alternative cover at a 34-acre former industrial waste landfill impacted by metals. The phytocap, consisting of 18,500 trees, resulted in substantial cost savings when compared to a traditional Resource Conservation and Recovery Act cap (USEPA, 2012f).

Capping remedies meet or exceed all CERCLA evaluation criteria.

As required by CERCLA, the capping options (and all remedial alternatives) for the three former disposal areas were evaluated relative to USEPA's threshold and modifying criteria. In the three FS reports

(ARCADIS, 2011a, 2012a, and 2012b), the alternatives are evaluated both on an individual and comparative basis.

- **Overall Protection of Human Health and the Environment –** The capping alternatives are protective of human health and the environment because they eliminate the key remaining exposure pathways for human and ecological receptors: direct contact and incidental ingestion.

- **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) –** Capping addresses chemical-specific ARARs, and action-specific and location-specific ARARs and To Be Considereds (TBCs) will be met as well, including wetland mitigation.

- **Long-Term Effectiveness and Permanence –** The capping remedies are proven, stable, and permanent solutions that will maintain their effectiveness over time. Long-term monitoring and maintenance programs, along with institutional controls, will provide further assurance of effectiveness and permanence.

- **Reduction of Toxicity, Mobility, and Volume Through Treatment –** Although capping alternatives do not involve treatment, source removal at the site has already significantly reduced the impacts across the site to the point where today only small areas of concern remain – it is these areas that are to be addressed through selection of final remedies. Engineered caps placed over the former disposal areas will reduce mobility of the residual low-level threat wastes and associated constituents.

- **Short-Term Effectiveness –** The capping alternatives are effective in the short term and can be implemented quickly with little disruption to the local community. Although the community, workers, and environment could be temporarily affected by traffic and dust from trucks hauling materials to the site for placement during the cap construction, potential impacts would be significantly less and of shorter duration than excavation remedial alternatives that would require waste materials to be transported to an offsite facility via local roads – traffic that would unavoidably move through some residential neighborhoods.

- **Implementability –** Capping technology is proven and reliably deployed using standard construction techniques, equipment, and workers. A removal alternative would take longer to implement than a capping option, unnecessarily delaying time to closure of the site.

Removal presents more hazards and risks than capping, without providing additional protection.

CERCLA requires program managers to consider the risks associated with implementation of the remedy, and it is clear that a removal effort would present far more short-term hazards and concerns than capping. For example, unlike containment and capping in place, excavation would pose additional risks to workers as they are directly exposed to the waste materials targeted for removal and required to face the physical dangers of attempting to excavate materials from depths extending to 100 feet below ground surface (in the PMP). Given that the mine pits have a long history of varied ownership and use, the physical condition and stability of the remaining subsurface mine structures also present a danger to workers and could cause substantial short- and long-term delays in implementing the removal alternatives safely without injury to workers, oversight personnel, and equipment in place to perform the work.

Transportation-related hazards are also substantial, especially for removal alternatives due to the extraordinary number of trucks and frequency of truck trips to implement the work. Specifically, the trucks used to transport the removed materials for offsite disposal would pose a hazard to the community in terms of increased noise, dust, and traffic on narrow local roads; wear and tear on those roads; and an increased risk of motor vehicle accidents. These hazards would extend beyond local impacts to the

Ringwood community and cause impacts along the entire transport route to offsite disposal facilities, which are up to 100 miles away from the site. An analysis of traffic safety impacts associated with a large-scale removal indicates (Sam Schwartz Engineering, 2012; Attachment 1):

- Excavation and backfill of the former disposal areas would require 500 project days and 47,385 truck trips. Comparatively, capping of the former disposal areas would require 7,225 truck trips.
- Complete removal of the three former disposal areas would statistically result in approximately 14.7 crashes, including 2.5 injuries and 0.07 fatalities. Of these, 1.2 total crashes, 0.2 injury crashes, and 0.006 fatal crashes are estimated to occur on local roads in Ringwood. Put differently, the traffic safety impacts associated with removal and backfill represent an incremental risk of 12.5 crashes compared to a capping remedy.

In addition to traffic safety impacts, excavation is expected to result in the following:

- Frequent automobile and pedestrian interaction with heavy dump trucks as trucks pass through intersections and in front of homes, businesses, parks, and schools about every 3 minutes.
- Measurable and noticeable increase in noise, as nominal conditions today are relatively quiet compared to frequent trucks accelerating, braking, and maneuvering local hills and turns.
- Increased potential for dust generation, although engineering controls would help manage dust.
- Periods of congestion and traffic backups because the movement, staging, and frequency of truck traffic is severely constrained by the narrow local roads and remote location of the site.
- Hastened wear and tear on roads, especially smaller, narrow roads not designed for heavy trucks.
- Project delays due to these and other transportation-related constraints could substantially limit available work hours (and available calendar months when weather impacts on roads are also considered) and thus reduce productivity of removal and extend the project duration several months or more.

There would be truck traffic associated with capping, but those trucks would only be hauling in clean materials to construct the caps, not hauling waste materials from the site and through nearby neighborhoods onto the transport route to disposal facilities. Taken together, the additional short-term effectiveness considerations associated with removal are not incidental and not worth the added risk, particularly considering that the capping options can achieve all RAOs and satisfy all CERCLA requirements for the ACs – including long-term protectiveness and effectiveness – in less time, for less cost, and without the additional hazards created by excavation and offsite transport.

SUMMARY: Selection of an effective risk-based final remedy is within sight, and onsite containment via capping makes sense for the Ringwood Mines/Landfill Site

As the NRRB considers both the long history and today's very different and improved current conditions at the Ringwood Mines/Landfill Site, the following are key lines of evidence leading to the conclusion that capping, institutional controls, and continuation of long-term monitoring makes the most sense as a final remedy protective of human health and the environment.

1) The Ringwood Mines/Landfill Site has been studied extensively, with the remedial investigation findings now more than sufficient to characterize nature and extent, understand fate and transport, evaluate remedial alternatives, and select a final remedy for areas not already addressed through source removal and other interim remedial measures.

2) Extensive source control removal actions are nearly complete across the 455-acre site, leaving only residual conditions to address at the three former disposal areas that together comprise just 22 acres.

3) The site-specific risk assessments show that, under current conditions, only the very conservative (and unrealistic) hunter exposure scenario exceeds USEPA's cancer risk guidelines and target hazard index, and those risks are driven by arsenic most likely (based on relative mass) derived from the large volume of U.S. Government mine tailings at the ACs and due to naturally occurring background in regional soils.

4) The sporadic and infrequent detections of arsenic and lead in site-related groundwater, along with the presence of low levels of benzene present in the PMP Area, can be addressed effectively through implementation of institutional controls and long-term monitoring. A restriction on well installation and use will prevent future exposure to groundwater, and long-term monitoring will continue to track natural attenuation and the decrease in COC concentrations over time. Moreover, NJDEP and USEPA have already confirmed through long-term monitoring that there is no offsite migration of COCs in groundwater or surface water and no site-related impacts to the Wanaque Reservoir.

5) Capping achieves all RAOs established for the former disposal areas and provides an appropriate degree of long-term effectiveness to prevent direct contact or other potential incidental exposure to the U.S. Government mine tailings, municipal refuse, and other materials restricted within the three former disposal areas. Indeed, there is no risk-based justification or need for the more intrusive, costly, and infeasible removal alternatives that, if implemented, would in turn create additional, unnecessary risks to both workers and neighbors.

6) Capping is the best approach to facilitate installation of a final remedy that achieves risk reduction for COCs of interest, does not create new additional hazards, and is consistent with CERCLA guidance that requires USEPA to favor remedies that promote green remediation and beneficial reuse.

7) Capping is USEPA's presumptive remedy for sites exhibiting similar past and current conditions, and at this site, a containment strategy satisfies all relevant CERCLA/ National Contingency Plan goals and criteria.

8) Containment via capping is consistent with the approaches employed at other similar, or even more impacted sites across the United States. Capping would, therefore, fulfill the NRRB's goal of assuring consistency across the country of remedial selection relative to CERCLA criteria and requirements.

References

ARCADIS. 2005. Results of the Field Reconnaissance Survey of the Ringwood Mines/Landfill Site. Ringwood, New Jersey. Prepared for the Ford Motor Company. October 3.

ARCADIS. 2008a. Report on Supplemental Investigation of Non-Residential Areas at the Ringwood Site. January 22.

ARCADIS. 2008b. Draft Report on Investigation of Mine Tailings and Background Soils, Ringwood Mines/Landfill Site, Ringwood, New Jersey. June 6, 2008.

ARCADIS. 2011a. Draft Feasibility Study – Peter's Mine Pit Area, Ringwood Mines/Landfill Site Ringwood, New Jersey. Prepared by ARCADIS on behalf of Ford Motor Company. May 2011. Revised October 2011.

ARCADIS. 2011b. Baseline Human Heath Risk Assessment for Peter's Mine Pit Area of Concern, Ringwood Mines/Landfill Site, Ringwood, New Jersey. Prepared by ARCADIS on behalf of Ford Motor Company. Revised August 2011.

ARCADIS. 2012a. Draft Feasibility Study – Cannon Mine Pit Area, Ringwood Mines/Landfill Site Ringwood, New Jersey. Prepared by ARCADIS on behalf of Ford Motor Company. March 2012.

ARCADIS. 2012b. Draft Feasibility Study – O'Connor Disposal Area, Ringwood Mines/Landfill Site Ringwood, New Jersey. Prepared by ARCADIS on behalf of Ford Motor Company. May 2012.

ARCADIS. 2012c. Draft Baseline Human Health Risk Assessment for the Cannon Mine Pit Area, Ringwood Mines/Landfill Site, Ringwood, New Jersey. April 20, 2012.

ARCADIS. 2012d. Draft Baseline Human Health Risk Assessment for the O'Connor Disposal Area, Ringwood Mines/Landfill Site, Ringwood, New Jersey. April 20, 2012.

ARCADIS. 2013. Draft Site-Wide Groundwater Remedial Investigation Report, Ringwood Mines/Landfill Site, Ringwood, New Jersey. January 2013.

Argonne National Laboratory. 2013. Peconic River Remedial Alternatives. Accessed online May 2013 at http://www.bnl.gov/erd/Peconic/Factsheet/Phytostab.pdf

Henry. J.R. 2000. An Overview of Phytoremediation of Lead and Mercury. Prepared for USEPA Office of Solid Waste and Emergency Response Technlology Innovation Office. May-August 2000.

ITRC. 2010a. Technology Overview: Capping/Covers and Grading. Interstate Technology & Regulatory Council, Mining Waste Team. August 2010.

ITRC. 2010b. Boston Mill Site Pilot Study, Cochise County, Arizona. Mine Waste Treatment Technology Selection Web. Washington, D.C.: Interstate Technology & Regulatory Council, Mining Waste Team. Accessed online at http://www.itrcweb.org/miningwaste-guidance/cs65_boston_mill.htm. August 2010.

NJDHSS. 2011a. Health Consultation. Cancer Incidence in the Population Living near the Ringwood Mines/Landfill Site, 1979-2008. RINGWOOD BOROUGH, PASSAIC COUNTY, NEW JERSEY, EPA FACILITY ID: NJD980529739. Prepared by the New Jersey Department of Health and Senior Services, DECEMBER 13, 2011, under a Cooperative Agreement with the U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation. Accessed online at: http://www.atsdr.cdc.gov/HAC/pha/RingwoodcancerincidenceHC/RingwoodcancerincidenceHCFinal.pdf

NJDHSS. 2011b. Health Consultation. Childhood Blood Lead Data in the Population Living near the Ringwood Mines/Landfill Site, July 1999 to December 2010. RINGWOOD BOROUGH, PASSAIC COUNTY, NEW JERSEY, EPA FACILITY ID: NJD980529739. Prepared by the New Jersey Department of Health and Senior Services, DECEMBER 13, 2011, under a Cooperative Agreement with the U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation. Accessed online at: http://www.atsdr.cdc.gov/HAC/pha/UpdatedRingwoodchildhoodbloodlead/UpdatedRingwoodchildhoodbloodleadFinalHC.pdf

Sam Schwartz Engineering. 2012. Ringwood Mines Traffic Study Analysis. December 2012.

USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA.* Interim Final. EPA/540/G-89/004. OSWER Directive 9355.3-01. October 1988. Accessed online at: http://www.epa.gov/superfund/policy/remedy/pdfs/540g-89004-s.pdf

USEPA. 1995. *Land Use in the CERCLA Remedy Selection Process*. OSWER Directive No. 9355.7-04. Memorandum from Elliott P. Laws, Assistant Administrator, to USEPA Directors. May 25, 1995

USEPA. 1998. EPA Superfund Record of Decision. Asbestos Dump, EPA ID: NJD980654149/OU3, 09/08/1998. Accessed online at: http://www.epa.gov/superfund/sites/rods/fulltext/r0298053.pdf

USEPA. 2008. USEPA Fact Sheet on Ringwood Mines/Landfill Site. EPA ID#: NJD980529739. December 2008. Accessed online at: http://www.epa.gov/region02/superfund/npl/0200663c.pdf

USEPA. 2009. USEPA Region 2 Clean and Green Policy. March 2009 (Updated March 2012).

USEPA. 2010a. Final Report. Data Summary. Ringwood Biological Sampling Efforts2006 Through 2009. Ringwood Mines/Landfill Site. Ringwood, New Jersey. June 2010. USEPA Contract No.: EP-C-04-032.

USEPA. 2010b. Superfund Green Remediation Strategy. Prepared by the USEPA Office of Superfund Remediation and Technology Innovation. September 2010

USEPA. 2011a. Action Memorandum: Approval and Funding for a Removal Action and 12-Month Exemption at the Ringwood Mines/Landfill Site, Ringwood Borough, Passaic County, New Jersey. September 2011.

USEPA. 2011b. Ringwood Mines/Landfill Site – Removal Polrep #1 and #2, Initial Removal Polrep. November 2011.

USEPA 2011c. Ringwood Mines/Landfill Site – Removal Polrep #3. December 2011.

USEPA. 2012a. Superfund Site Progress Profile: Asbestos Dump (EPA ID: NJD980654149). Accessed online at: http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0200769

USEPA. 2012b. *Presumptive Remedies: CERCLA Landfill Caps RI/FS Data Collection Guide*. Updated. Accessed online at: http://www.epa.gov/superfund/policy/remedy/presump/caps.htm

USEPA. 2012c. Moyers Landfill, Current Site Information (EPA ID: PAD980508766). Accessed online at: http://www.epa.gov/reg3hscd/npl/PAD980508766.htm

USEPA 2012d. Ringwood Mines/Landfill Site – Removal Polrep #4. June 2012.

USEPA 2012e. Ringwood Mines/Landfill Site – Removal Polrep #5. July 2012.

USEPA 2012f. Ringwood Mines/Landfill Site – Removal Polrep #6. August 2012.

USEPA 2012g. Engineering Forum August 1, 2012 Teleconference Minutes. Accessed online at http://www.epa.gov/superfund/remedytech/tsp/download/teleconf/eng12aug.html. August 2012.

USEPA 2012h. Ringwood Mines/Landfill Site – Removal Polrep #7. September 2012.

USEPA 2012i. Ringwood Mines/Landfill Site – Removal Polrep #8. September 2012.

USEPA 2012j. Ringwood Mines/Landfill Site – Removal Polrep #9. October 2012.

Attachment 1

December 2012 Traffic Study

SAM SCHWARTZ ENGINEERING

To: Erich Zimmerman, ARCADIS

Date: December 4, 2012

Subject: Ringwood Mines Traffic Safety Analysis

On behalf of ARCADIS US (ARCADIS), Sam Schwartz Engineering (SSE) conducted an analysis of traffic safety impacts associated with a large-scale excavation of contaminated soil from the Ringwood Mines Superfund Site located in the Borough of Ringwood, NJ.

In summary, complete removal of the landfill materials will statistically result in approximately 14.7 crashes, including 2.5 injuries and 0.07 fatalities. Of these, the approximate numbers of crashes expected to occur on local roads in Ringwood, NJ are estimated to be 1.2 total crashes, 0.2 injury crashes, and 0.006 fatal crashes.

Background

The removal of landfill material and backfilling with clean fill is among the remediation strategies under consideration by the United States Environmental Protection Agency for the Ringwood Mines/ Landfill Site. Based on information provided to SSE by ARCADIS, it is anticipated that complete removal of landfill material and backfilling with clean fill will require 500 project days to complete. The associated hauling operations would add an estimated 47,385 truck trips (one-way trips) to local area roadways and Interstate highways over the contemplated project duration. It was further indicated in information provided to SSE by ARCADIS that the most efficient route to the Interstate system traverses through the following local intersections in Ringwood, NJ:

- Margaret King Road and Sloatsburg Road
- Margaret King Road and Peter's Mine Road
- Margaret King Road and Boro Parkway
- Margaret King Road and Milligan Drive

SSE derived an estimate of the potential traffic safety impacts associated with the addition of 47,385 truck trips (one-way trips) based on the routing information provided to SSE by ARCADIS, a review of available crash data associated with the affected roads, and published studies that estimate crash rates by vehicle type.

Methodology

1. SSE worked with ARCADIS to identify a route map for trucks that would access and egress the Ringwood Mines landfill site under the soil removal/backfill strategy. It was assumed by ARCADIS that approximately 75 percent of the trucks would travel to IESI Corp. in Bethlehem, PA, and the other 25 percent would travel to Clean Earth of New Jersey Inc., in Kearny, NJ.
2. SSE estimated the number of miles that would be traveled by the dump trucks on each affected road segment.
3. SSE reviewed digital images of each road along the travel route to determine the basic cross-section geometry.

4. For each State road segment along the proposed travel route, SSE determined the most recent (2011) overall crash rate per million vehicle miles of travel for these roads based on data available through the New Jersey Department of Transportation (NJDOT).
5. For each local road segment along the proposed travel route, SSE determined the most recent (2011) New Jersey statewide crash rate per million vehicle miles of travel by cross-section geometry based on data available through NJDOT.
6. Using the information derived through the above noted process, SSE computed the expected number of crashes for each road segment based on the estimated number of vehicle miles of travel generated by the soil removal/backfill activity.
7. In order to account for higher crash rates for trucks as compared to the overall vehicle population, SSE reviewed published studies from additional jurisdictions that estimated crash rates by vehicle type. Two studies were identified: Crabtree and Agent (1982) reported crash rates by vehicle type for Kentucky; Montufar et al. (2007) reported crash rates by vehicle type for Alberta, Canada. Both studies concluded that crash rates were higher for single-unit trucks than for overall traffic. SSE selected the midpoint between these two studies to derive at an Estimated Single Unit Truck Factor (ESUTF) of approximately 2.0. The NJDOT crash rates were multiplied by the ESUTFs to account for the increased crash rates associated with single-unit trucks.
8. A Single Unit Truck Crash Rate (SUTCR) per million vehicle miles was computed for each road segment by multiplying the approximate number of miles for each road segment x the NJDOT crash rates associated with each road segment x the Estimated Single Unit Truck Factor.
9. The estimated number of crashes was computed by multiplying the Single Unit Truck Crash Rate x truck volume, and dividing the resultant by 1,000,000.
10. SSE used the New Jersey 2009-2011 statewide percent of total crashes resulting in reported injuries and fatalities for 3-axle single-unit trucks to estimate the number of injury crashes and fatal crashes associated with additional truck trips.

Methodology Notes

1. This analysis provides an empirically based estimate of the approximate number of crashes associated with additional truck trips accessing and egressing the Ringwood Mines landfill site. The estimated number of additional crashes associated with these added truck trips does not include the base number of crashes associated with routine travel along the study routes.
2. The source for clean fill will vary based on availability. Clean soil and stone fill will likely be obtained from a variety of local sources; but to stay consistent with the risks posed under excavation, ARCADIS instructed SSE to use the same routing as was applied for excavation. This assumption may result in an overestimate of the overall crash risk to the extent that sources of clean fill are closer in proximity to the Site as compared to the disposal sites.

Results

Tables 1A and 1B provide the expected routes for trucks accessing the Ringwood Mines landfill site under the soil removal/backfill strategy, as well as the estimated number of miles that would be traveled by the dump trucks on each affected road segment:

Table 1A

	Route Description to Bethlehem, PA	Functional Classification	Approx. Miles
1	Peter's Mine Road	Urban Minor Arterial	1.0
2	Margaret King Avenue (Passaic County 698 West to East)	Urban Minor Arterial	0.6
3	Sloatsburg Road (Passaic County 697 South to North)	Urban Principal Arterial	1.9
4	County Road 511S/ Greenwood Lake Turnpike	Urban Principal Arterial	7.1
5	County Rd 511 S/ Union Ave	Urban Minor Arterial	0.1
6	I-287 S toward Morristown	Urban Interstate	33.9
7	Exit 21B to merge onto I-78 W toward Easton Pa	Urban/Rural Interstate	41.3
8	Exit 67 for PA-412 toward Hellertown/ Bethlehem	Urban Principal Arterial	0.7
9	PA-412 N/ Hellertown Road	Urban Principal Arterial	0.8
10	Shimersville Road	Urban Minor Arterial	0.8
11	Applebutter Road	Urban Minor Arterial	1.5
		Σ =	89.7

Table 1B

	Route Description to Kearny, NJ	Functional Classification	Approx. Miles
1	Peter's Mine Road	Urban Minor Arterial	1.0
2	Margaret King Avenue	Urban Minor Arterial	0.6
3	Sloatsburg Road	Urban Principal Arterial	0.7
4	Mill Pond Road	Urban Principal Arterial	1.0
5	County Road 72/ Sterling Mine Road	Urban Principal Arterial	3.1
6	NY-17S/ Orange Turnpike	Urban Principal Arterial	1.3
7	NY 17 S/I-87 S/NY Thruway Ramp to I-287	Urban Principal Arterial	0.3
8	I-87 S	Urban Principal Arterial	0.9
9	Exit 15 to NY-17 S/I-287 S toward New Jersey	Urban Principal Arterial	0.8
10	I-287 S	Urban Principal Arterial	0.6
11	Exit 66 to NJ-17 S toward Mahwah	Urban Principal Arterial	13.7
12	NJ-17 S	Urban Principal Arterial	3.8
13	I-80 E toward New York	Urban Interstate	2.9
14	Exit I-95 S	Urban Interstate	1.9
15	Exit 16W toward Rutherford	Urban Interstate	0.6
16	I-95 S	Urban Interstate	9.0
17	Exit 15E toward Jersey City	Urban Interstate	1.0
18	U.S. 1 Truck N/US-9 Truck N/Lincoln Hwy/Raymond Blvd	Urban Principal Arterial	0.4
19	Jacobus Avenue	Urban Minor Arterial	0.2
20	Jacobus Avenue	Urban Minor Arterial	0.5
		Σ =	44.3

Tables 2A and 2B provide the NJDOT crash rates for each road segment:

Table 2A

	Route Description to Bethlehem, PA	NJDOT Crash Rate
1	Peter's Mine Road	3.95
2	Margaret King Avenue (Passaic County 698 West to East)	3.95
3	Sloatsburg Road (Passaic County 697 South to North)	3.95
4	County Road 511S/ Greenwood Lake Turnpike	4.58
5	County Rd 511 S/ Union Ave	3.95
6	I-287 S toward Morristown	1.39
7	Exit 21B to merge onto I-78 W toward Easton Pa	1.27
8	Exit 67 for PA-412 toward Hellertown/ Bethlehem	4.15
9	PA-412 N/ Hellertown Road	4.15
10	Shimersville Road	4.69
11	Applebutter Road	3.95
	Average =	3.63

Table 2B

	Route Description to Kearny, NJ	NJDOT Crash Rate
1	Peter's Mine Road	3.95
2	Margaret King Avenue	3.95
3	Sloatsburg Road	3.95
4	Mill Pond Road	3.95
5	County Road 72/ Sterling Mine Road	3.51
6	NY-17S/ Orange Turnpike	2.23
7	NY 17 S/I-87 S/NY Thruway Ramp to I-287	2.23
8	I-87 S	2.57
9	Exit 15 to NY-17 S/I-287 S toward New Jersey	1.39
10	I-287 S	1.39
11	Exit 66 to NJ-17 S toward Mahwah	2.23
12	NJ-17 S	2.23
13	I-80 E toward New York	1.80
14	Exit I-95 S	1.37
15	Exit 16W toward Rutherford	1.37
16	I-95 S	1.37
17	Exit 15E toward Jersey City	2.66
18	U.S. 1 Truck N/US-9 Truck N/Lincoln Hwy/Raymond Blvd	3.84
19	Jacobus Avenue	3.95
20	Jacobus Avenue	3.95
	Average =	2.69

Tables 3 and 4 present the total truck trips associated with the capping and excavation remedy for the three land-based on the Borough areas of Ringwood, NJ. These data was provided to SSE by ARCADIS.

Table 3: Calculation of Total Truck Trips Associated with Capping of the Three Land-Based Areas of Concern, Ringwood Mines/ Landfill Site, Ringwood, NJ

Area of Concern	Soil Tons Associated with Capping Alternative [1]	Truck Loads Assuming 25 Tons/Truck Load	Truck Trips @ Two Trips Per Load	Notes
Peters Mine Pit Area	18,000	720	1,440	Clean Fill Within Pit
	12,000	480	960	Clean Fill Contour Grade
	6,000	240	480	Top Soil
Subtotal:	36,000	1,440	2,880	
Cannon Mine Pit Area	5,900	236	472	Clean Fill
	1,200	48	96	Top Soil
		0	0	
Subtotal:	7,100	284	568	
O'Connor Disposal Area	30,500	1,220	2,440	Clean Fill
	16,710	668	1,337	Top Soil
Subtotal:	47,210	1,888	3,777	
Total for All Areas:	90,310	3,612	7,225	

Note:
1. For the O'Connor Disposal Area, the Waste Consolidation with Soil Capping Alternative was used for estimating purposes.

Table 4: Calculation of Total Truck Trips Associated with Excavation of the Three Land-Based Areas of Concern, Ringwood Mines/ Landfill Site, Ringwood, NJ

Area of Concern	Soil Tons Associated with Excavation Alternative	Truck Loads Assuming 25 Tons/Truck Load	Truck Trips @ Two Trips Per Load	Notes
Peters Mine Pit Area	92,361	3,694	7,389	Excavation
	110,883	4,435	8,871	Clean Fill Backfill
	3,694	148	296	Top Soil
Subtotal:	206,938	8,278	16,555	
Cannon Mine Pit Area	45,800	1,832	3,664	Excavation
	45,800	1,832	3,664	Clean Fill Backfill
	1,650	66	132	Top Soil
Subtotal:	93,250	3,730	7,460	
O'Connor Disposal Area	275,420	11,017	22,034	Excavation
	16,707	668	1,337	Top Soil
Subtotal:	292,127	11,685	23,370	
Total for All Areas:	592,315	23,693	47,385	

Table 5A and 5B provide data to compute the estimated number of crashes for 47,385 truck trips based on the assumed routing, the NJDOT crash rates for each road segment along the proposed travel route, and the adjustment to New Jersey standard crash rates based on SSE's review of published studies that estimate crash rates by vehicle type.

Table 5A

	Route to Bethlehem, PA	Approx. Miles (A)	NJDOT Crash Rates (B)	ESUTF* (C)	SUTCR** (A x B x C)
1	Peter's Mine Road	1.0	3.95	1.86	7.37
2	Margaret King Avenue (Passaic County 698 West to East)	0.6	3.95	1.86	4.42
3	Sloatsburg Road (Passaic County 697 South to North)	1.9	3.95	1.96	14.68
4	County Road 511S/ Greenwood Lake Turnpike	7.1	4.58	1.96	63.56
5	County Rd 511 S/ Union Ave	0.1	3.95	1.86	0.74
6	I-287 S toward Morristown	33.9	1.39	2.45	115.67
7	Exit 21B to merge onto I-78 W toward Easton Pa	41.3	1.27	2.09	109.51
8	Exit 67 for PA-412 toward Hellertown/ Bethlehem	0.7	4.15	1.96	5.68
9	PA-412 N/ Hellertown Road	0.8	4.15	1.96	6.49
10	Shimersville Road	0.8	4.69	1.86	7.00
11	Applebutter Road	1.5	3.95	1.86	11.05
	Total				346.2

*ESUTF - Estimated Single Unit Truck Factor

**SUTCR - Single Unit Truck Crash Rate

Estimated Number of Crashes (C) for Bethlehem Route:

C = (Single Unit Truck Crash Rate x Truck Volume) / 1,000,000

C = (346.2 x 35,539) / 1,000,000 = 12.3

Table 5B

	Route to Kearny, NJ	Approx. Miles (A)	NJDOT Crash Rates (B)	ESUTF* (C)	SUTCR** (A x B x C)
1	Peter's Mine Road	1.0	3.95	1.86	7.37
2	Margaret King Avenue	0.6	3.95	1.86	4.42
3	Sloatsburg Road	0.7	3.95	1.96	5.41
4	Mill Pond Road	1.0	3.95	1.96	7.73
5	County Road 72/ Sterling Mine Road	3.1	3.51	1.96	21.25
6	NY-17S/ Orange Turnpike	1.3	2.23	1.96	5.67
7	NY 17 S/I-87 S/NY Thruway Ramp to I-287	0.3	2.23	1.96	1.31
8	I-87 S	0.9	2.57	1.96	4.52
9	Exit 15 to NY-17 S/I-287 S toward New Jersey	0.8	1.39	1.96	2.18
10	I-287 S	0.6	1.39	1.96	1.63
11	Exit 66 to NJ-17 S toward Mahwah	13.7	2.23	1.96	59.76
12	NJ-17 S	3.8	2.23	1.96	16.58
13	I-80 E toward New York	2.9	1.80	2.45	12.81
14	Exit I-95 S	1.9	1.37	2.45	6.39
15	Exit 16W toward Rutherford	0.6	1.37	2.45	2.02
16	I-95 S	9.0	1.37	2.45	30.27
17	Exit 15E toward Jersey City	1.0	2.66	2.45	6.53
18	U.S. 1 Truck N/US-9 Truck N/Lincoln Hwy/Raymond Blvd	0.4	3.84	1.96	3.00
19	Jacobus Avenue	0.2	3.95	1.86	1.47
20	Jacobus Avenue	0.5	3.95	1.86	3.68
	Total				204.0

*ESUTF - Estimated Single Unit Truck Factor
**SUTCR - Single Unit Truck Crash Rate

Estimated number of crashes (C) for Kearny Route:

C = (Single Unit Truck Crash Rate x Truck Volume) / 1,000,000
C = (204 x 11,846) / 1,000,000 = 2.4

Estimated number of crashes for the combined routes = 14.7

R2-0004344

Conclusions

Based on the data provided to SSE by ARCADIS, and the empirical approach/assumptions described in this memo, an estimated 14.7 crashes are associated with the addition of 47,385 truck trips to local area and Interstate roadways over the contemplated project duration. Based on statewide NJDOT data regarding the percent of 3-axle single unit truck crashes resulting in reported injuries and fatalities, SSE estimated the number of injury crashes and fatal crashes associated with the addition of 47,385 truck trips as shown in Table 7.

Table 6: New Jersey statewide injuries and fatalities for 3-axle single-unit trucks (2009-2011)

	Total	Percent
Fatal Crashes	34	0.454%
Injury Crashes	1,260	16.838%
Property Damage Only Crashes	6,189	82.707%
Total	7,483	100%

Table 7

	Factor (from Table 6)	x total crashes	Estimated # Crashes
Fatal Crashes	0.00454	x 14.7	0.06688
Injury Crashes	0.16838	x 14.7	2.47847
Property Damage Only Crashes	0.82707	x 14.7	12.17403
Total			14.7

The corresponding estimated numbers of crashes for local area roads (segments of Peter's Mine Road, Margaret King Avenue, Sloatsburg Road, and Mill Pond Road) is 1.2 total crashes, 0.2 injury crashes, and 0.006 fatal crashes.

The above estimated traffic safety impacts associated with an excavation remedy (47,385 total truck trips) can also be viewed comparatively against the impacts associated with a capping remedy, which would require 7,225 total truck trips (as indicated by ARCADIS at Table 3). Based on the same methodology and assumptions used above, the excavation remedy would have an incremental risk of 12.5 crashes, as compared to a capping remedy. Of the estimated 12.5 crashes, approximately 2.1 would be injury crashes, and 0.057 would be fatal crashes.

References

Crabtree, J.D. and Agent, K.R. 1982. Accident Rates by Vehicle Type. Kentucky Transportation Research Program Report Number UKTRP-82-12.

Montufar, J.; Regehr, J.; Rempel, G.; and McGregor, R.V. 2007. Long Combination Vehicle (LCV) Safety Performance in Alberta: 1999–2005. Alberta Infrastructure and Transportation Policy and Corporate Services Division.

New Jersey Department of Transportation. 2012. Crash Records. http://www.state.nj.us/transportation/refdata/accident/

Turner, D.S. and Nicholson, L.A. 2009. A Synthesis of Safety Implications of Oversize/Overweight Commercial Vehicles. University Transportation Center for Alabama Report Number 07115.

WGM Group. 2011. The University of Montana Biomass Plant Project – Draft Transportation Impact Assessment. Missoula, MT. WGM Project No. 100815.

Attachment 2

2013 Summary Report - Paint Waste Investigation and Removal Actions

Ringwood Mines/Landfill Site
Ringwood, New Jersey

2013 Summary Report - Paint Waste Investigation and Removal Actions

Ford Motor Company
May 28, 2013

BACKGROUND: Paint waste investigation and removal activities conducted to date have been thorough and complete.

Ford Motor Company, in coordination with the U.S. Environmental Protection Agency (USEPA), the New Jersey Department of Environmental Protection (NJDEP), the Borough of Ringwood, the Community Advisory Group, and others, has systematically evaluated the Ringwood Mines/Landfill Site to identify and remove paint waste from the site. This paper presents an updated overview of historical and current conditions, focusing on the methodology and effectiveness of paint waste investigation and removal activities completed to date. The most recent paint waste removal activities have resulted in the removal and offsite disposal of nearly all known surficial paint sludge, thereby permanently eliminating potential human or ecological exposure to these materials. Ford remains an active environmental steward at the site and will investigate and remove any paint waste deposits that may be identified outside the primary disposal areas in the future.

Identification and removal of paint waste has been thorough and systematic

- Potential paint waste disposal areas have been identified through a multi-step approach based on historical records; aerial maps; topographic maps; and information assembled from federal, state, and local stakeholders (e.g., USEPA, NJDEP, Borough of Ringwood officials, local residents, Community Advisory Group, and others).

- With regulatory oversight, crews trained in the identification of paint waste, drums, drum remnants, and soil conditions indicative of waste fill materials have systematically surveyed the Areas of Concern and potential secondary disposal areas. During survey work, crews collected and recorded data about locations of paint waste deposits and made other observations about the general conditions in the survey area, including noting when other waste materials (e.g., refuse) were collocated with paint waste.

- To date, crews have walked and recorded their observations along 93,000 linear feet (17 miles) of survey lines set up across the known and potential paint waste disposal areas. Crews stopped at 4,610 locations along the survey lines and collected detailed information, including samples of the subsurface. to identify current conditions and note if paint waste was present—96 percent of the locations had no evidence of paint waste (ARCADIS, 2005).

- In consultation with USEPA and NJDEP, crews completed additional investigation at 79 locations where paint waste was suspected based on potential anomalies discovered during historical research, mapping, and survey work. To be thorough, including investigation of conditions at depth, test pits were completed at these locations to see if paint waste was present below the ground surface. Paint waste deposits were found in 2 of the 79 test pits (ARCADIS, 2008a).

- Following the extensive survey and investigation work, paint waste deposits were assembled into 15 removal areas. Ford and its contractors then removed more than 47,000 tons of paint waste, soil, and other waste materials from the 15 removal areas and the three Areas of Concern (Peter's Mine Pit [PMP] Area, Cannon Mine Pit [CMP] Area, and O'Connor Disposal Area [OCDA]).

- As voluntary remedial measures conducted by Ford, the completed removal actions had one clear objective: achieve a high level of scientific confidence that all residual waste material (e.g., paint residue, paint sludge, paint waste) outside the three Areas of Concern is identified and removed, no matter how large or small a volume encountered.

- Excavation activities have been thorough, with field crews confirming that nearly all paint waste was removed. Confirmation test pits were excavated around removal areas to confirm additional deposits would not be missed. Post excavation soil samples were collected in accordance with NJDEP requirements to verify that concentrations of constituents of concern were below NJDEP criteria for residential contact and protection of groundwater. Once USEPA and NJDEP agreed that excavation activities in a removal area were complete, the excavation was backfilled with clean fill and the area restored.

Ford is committed to removing any additional paint waste that may be reported

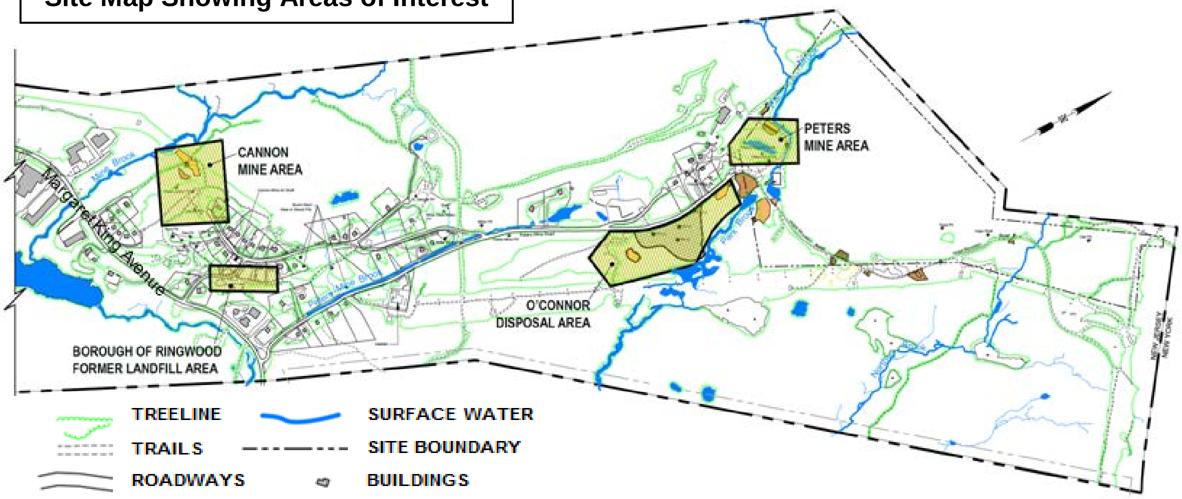
- Ford has and will continue to encourage stakeholders to contact Ford if they find a suspected deposit of paint waste. Ford and its contractors have been and will continue to be responsive to reports of suspected paint waste outside the Areas of Concern, and Ford has voluntarily expanded the scope of work at the site on several occasions to ensure that investigation and removal activities are comprehensive.

- Ford will voluntarily continue to address paint waste deposits outside the Areas of Concern. The Record of Decision issued by USEPA will reinforce this commitment with the inclusion of provisions requiring Ford to remove and dispose offsite any additional paint waste discovered outside the Areas of Concern that may be identified in the future.

Overview

In 2004, Ford Motor Company began voluntary and comprehensive site-wide investigation and removal of paint waste deposits at the Ringwood Mines/Landfill Site. The work was designed to supplement previous removal actions completed in the 1990s, and resulted in the successful removal and offsite disposal of more than 47,000 tons of paint waste, impacted soil, and other waste materials successfully removed and disposed of offsite. Ford is committed to addressing any additional site-related paint waste that may be identified now or in the future, and is currently preparing a work plan for USEPA approval to remove a small paint waste deposit recently discovered south of Margaret King Avenue.

Site Map Showing Areas of Interest



From 1967 to 1971, Ford contracted O'Connor Trucking and Haulage Company to transport waste from the former Ford Motor Plant in Mahwah to legally dispose of it in three areas at the site: the PMP Area, the Cannon Mine Pit (CMP) Area, and the OCDA. Apparently Ford wastes, including paint waste, were inappropriately disposed of by O'Connor in other, secondary locations; deposits in these secondary locations are the focus of the supplemental removal actions. All known deposits outside the primary disposal areas have been removed or will soon be removed according to the work plan currently in development.

Through review of available information, Ford and its contractors mapped all areas that may have served as secondary disposal areas either through direct disposal or through subsequent relocation of fill materials that may have contained paint waste. These areas were subject to a thorough methodology to identify paint waste deposits, including desk-top reviews of historical records, aerial maps, and topographic maps to locate areas that were known as or had the potential to serve as paint waste disposal areas. Visual survey by field crews were then conducted to record actual conditions and observations of paint waste along 17 miles (93,000 feet) of survey lines. Detailed data were collected at 4,610 locations, with paint waste observed at just 4 percent of the 4,610 locations (ARCADIS, 2005).

Following the visual survey, Ford worked closely with the NJDEP and USEPA to identify additional areas where fill materials may have been placed during the period of interest (1967 to 1971). At each of these locations, test pits were excavated to bedrock or the maximum reach of the excavation equipment. Paint waste was identified at 2 of the 79 locations (ARCADIS, 2008a). Ford also completed supplemental investigation work at the PMP Area, CMP Area, and the OCDA, including the completion of additional test pits, advancement of soil borings, collection and analysis of samples, and geophysical survey work to define the limits of paint waste deposits.

The investigation led to the identification of 15 removal areas mapped during the visual survey. Paint waste deposits in these 15 areas, and where identified within the PMP Area and OCDA, were excavated and disposed offsite under the oversight of USEPA.

Portion of removal area SR-3 following excavation, backfilling with clean soil, and restoration with native plants

Excavation activities were thorough, with the completion of additional confirmation test pits positioned around each removal area. Post excavation samples were also collected from the walls and floors of the excavations for laboratory analysis. When laboratory results confirmed that concentrations of constituents of concern were below applicable criteria — and USEPA concluded excavation was complete — the removal areas were backfilled with clean fill and restored as native habitat. Post excavation samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) (ARCADIS, 2004).

Ford remains committed to ongoing environmental stewardship at the site, and should any additional paint waste be found outside the primary disposal areas in the future (such as the paint waste deposit recently discovered south of Margaret King Avenue), Ford will promptly assess and remove the paint waste.

What is Paint Waste?

Automobile assembly operations at the former Mahwah plant involved painting automobiles and automobile parts in paint booths. The over-spray waste from the painting operations was mixed with water and solvents and collected for disposal in a sludge pit. Often the water was separated from the paint materials, leaving behind just paint materials. These materials, generally referred to as paint sludge, were transported and disposed of by O'Connor Trucking from 1967 to 1971 according to the regulatory requirements and accepted practices at the time.

Historical surficial paint waste is typically observed as a solid mass that resembles asphalt and often exhibits a weathered-gray color. Shown here (circled) among rocks and other debris is a small piece of paint waste that was removed and disposed of during the removal actions.

At the time the paint waste was collected and disposed, it was a semi-solid material. Over time, the material hardened into a solid, inert mass resembling lava or possibly slate. In larger deposits, the interior of the paint waste deposits may have remained in a semi-liquid form for a period of time with a hardened "crust" on the outside. Today, the hardened and sometimes pliable paint waste is typically found as chips, fragments, or chunks mixed with soil at the site (ARCADIS, 2008a).

Paint waste contains petroleum-related VOCs and SVOCs, along with marker metals of antimony, arsenic, barium, chromium, and lead. During the history of investigation and monitoring of groundwater at the site, none of these constituents have been detected consistently in surface water or monitoring wells at concentrations that pose a significant human health or ecological risk or that would define a large-scale groundwater plume. For example, benzene (a minor component in paint waste) is the only constituent (detected at low concentrations) found consistently to define a small localized impacted area within the PMP Area; most detections of constituents in groundwater, surface water, and soil have been sporadic and infrequent. Laboratory testing and evaluation of the physical and chemical properties of paint waste confirms that lead, arsenic, and other constituents of concern do not readily leach into soil or groundwater (ARCADIS, 2008c; 2008d). Indeed, during soil sampling for the supplemental paint waste removal actions, VOCs and SVOCs were detected in only a limited number of samples from around the removal areas, indicating that leaching or mobility of constituents from paint waste into the environment is limited, if any.

History of the Site and Paint Waste Disposal

The Ringwood Mines/Landfill Site is a historic iron mining site that operated from the 1700s until at least the early 1930s. In 1942, the U.S. Government purchased the Upper Ringwood Area (approximately 870 acres), and invested heavily in the mines to prepare them for potential use in World War II.

Activities conducted by the U.S. Government's lessee, the Alan Wood Steel Company, from 1942 until 1945 included the reconstruction of a number of mine-related structures; refurbishment of the mines' water supply system; dewatering of the mines; excavation and onsite disposal of over 100,000 cubic yards of waste rock and mine tailings (pulverized and small pieces of mined rock and mineral materials discarded after separation from iron ore during the mining process); re-opening, enlarging, reconditioning, and extending of the original mine levels; production and processing of some ore; and related activities. The U.S. Government sold the mines in 1947 to a private party, but the property reverted to the U.S. Government one year later after the private party filed for bankruptcy. As a result of this long history of mining operations, large volumes of mine tailings were disposed of onsite and then re-worked or scattered across the site. These U.S. Government mine tailings became commingled in some places with paint waste and municipal refuse disposed of at the site.

In 1958, the U.S. Government sold the property to Pittsburgh Pacific Company, and in 1965 Pittsburgh Pacific Company sold the property to the Ringwood Realty Corporation, a former subsidiary of Ford. Shortly after their purchase of the property, Ringwood Realty contracted O'Connor to dispose of paper, cardboard, wood, metal, plastic scrap, general trash, paint waste, scrap drums, car parts, and other non-liquid plant wastes from Ford's former Mahwah assembly plant. The agreement ran from 1967 until 1971, with O'Connor contracted to properly dispose of Ford wastes at three locations on the Ringwood Site: the PMP Area, the CMP Area, and the OCDA. O'Connor's disposal activities during this time were approved by state and local officials.

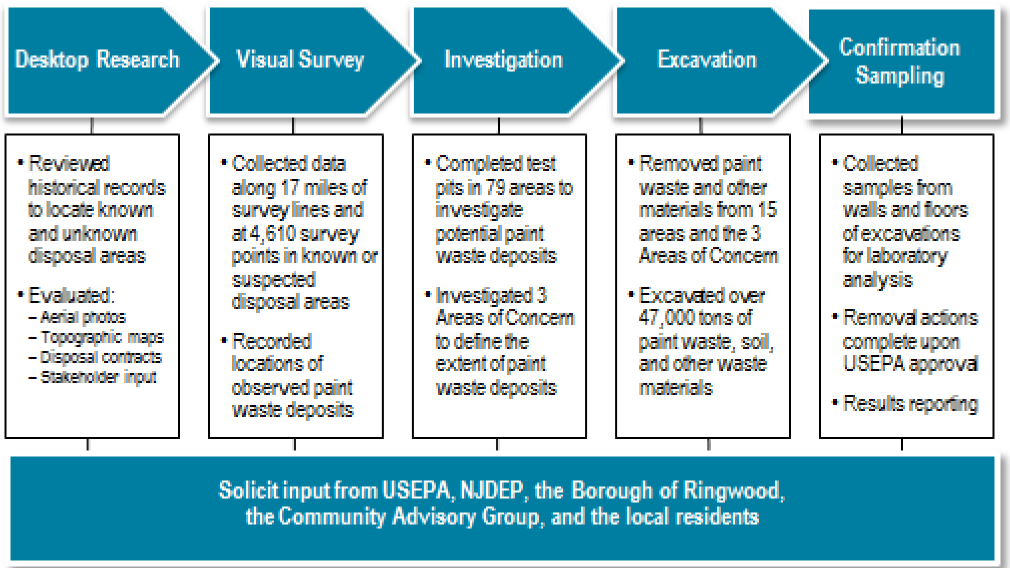
In November 1970, Ringwood Realty donated 290 acres of the site to the Ringwood Solid Waste Management Authority (RSWMA) and RSWMA accepted waste from O'Connor/Ford until Ford terminated its contract with O'Connor in 1971. By November 1971, Ringwood Realty had sold all but 145 acres of the site, and by December 1973 Ringwood Realty no longer owned any portion of the site.

While O'Connor was contracted to properly dispose of waste in the PMP Area, CMP Area, and OCDA, there is evidence that waste was disposed in other areas such as depressions adjacent to roadways, and in forested and unforested areas readily accessible by O'Connor's dump trucks. Further, some of the waste, including paint waste, was likely relocated by construction crews and others when fill material was transferred to other locations for use in construction or to fill low spots.

History of Paint Waste Investigation and Removal Actions

Environmental investigation began after the site was added to the National Priorities List in 1983. Between 1984 and 1988, Ford and its contractors completed several investigations to characterize conditions, identify potential hazards, assess risks to human health and the environment, and develop remedial options. The remedial investigation activities designed to characterize the site were approved by USEPA and included completing test pits; advancing borings; installing monitoring wells; and collecting soil, sediment, surface water, and groundwater samples for laboratory analyses.

Ford began paint waste removal activities with the removal of 11,300 tons of solidified paint waste in 1987 and 1988 from four areas identified during the early investigation work. In the 1990s, Ford removed approximately 660 additional tons of paint waste during three separate removal actions in 1990 to 1991, 1995, and 1997 to 1998. Beginning in 2004, Ford entered into an additional phase of investigation and cleanup work to supplement the work already completed. The flow chart below provides an overview of the investigation and removal process, which is described in greater detail in the following subsections.



In collaboration with USEPA, NJDEP, the Borough of Ringwood, the Community Advisory Group, and others, Ford developed a detailed screening process to identify and then visually search non-residential areas of the site that may have received Ford wastes. ARCADIS and the USEPA have also routinely requested information from residents regarding the locations of any known deposits of paint waste.

As a result of this supplemental investigation, Ford has completed additional removal actions—conducted voluntarily by Ford outside the scope of the current Administrative Order—that resulted in the removal and off-site disposal of an additional 47,000 tons of paint waste, impacted soil, and other waste materials from the site.

Review of Historical Information and Maps

Ford and its contractors used a scientifically sound multi-step effort to identify and evaluate known and unknown areas of the site that served or may have served as disposal areas for Ford wastes. The following informed the identification of areas for visual inspection and subsequent removal:

- **Historical research** confirmed the extent of the area used by O'Connor per the agreement with Ringwood Realty. Maps included with the agreement verify that O'Connor was contracted to dispose Ford wastes in the PMP Area, CMP Area, and OCDA. The boundaries of these disposal areas as defined in the agreement were mapped for inclusion in the visual survey.

- **Review of aerial photographs** identified areas of the site outside of the three primary disposal areas (i.e., PMP Area, CMP Area, and OCDA) that may have been suitable for disposal of Ford wastes. These areas were mapped for inclusion in the visual survey and included disturbed areas, paved and unpaved roads, level areas adjacent to roads, ravines adjacent to roads, and other surface depressions.

- **Review of topographic maps** identified areas of the site where historical filling may have occurred in low-lying areas. Areas where the elevation changed greater than 1 foot between 1961 and 1974 were mapped for inclusion in the visual survey.

- **Community input** gathered during public meetings attended by residents, the Borough of Ringwood officials, and attorneys representing residents was used to map other areas of suspected paint waste not covered by other research and target these areas for evaluation during the comprehensive field reconnaissance survey conducted by ARCADIS within suspected disposal areas. Ford has remained open to similar input and is committed to prompt removal of paint waste deposits outside the primary disposal areas that may be found in the future.

Using this process (described in more detail in the *Results of the Reconnaissance Survey Report* [Recon Report; ARCADIS, 2005]), all non-residential areas that could have reasonably been used by O'Connor for paint waste disposal were targeted in the visual survey. Note that residential areas (and areas being used by the residences as extensions of personal property) were not surveyed during this process because USEPA is leading the investigation and removal of paint waste in those areas. The approach encompassed the entire site, and the first portions to be considered were those identified during the desktop review as inaccessible by a dump truck and therefore impossible or improbable to access for disposal purposes between 1967 and 1971. For example, areas screened out for no further investigation included areas without access roads suitable for truck traffic and areas adjacent to access roads that were at a higher elevation than the access road and thus could not have been accessed or used for disposal. In addition, much of the site is mountainous or hilly with steep terrain, has physical or topographic obstructions, and has dense trees and vegetation that would not have allowed access by O'Connor's trucks. When taken together, it was reasonable to conclude that areas inaccessible to a dump truck (such as that used during disposal activities in 1967 to 1971) would not contain paint waste deposits; these areas physically could not have received paint waste via O'Conner trucks.

Completion of Systematic Visual Survey

Like the gathering of information to identify potential disposal areas, the visual survey itself was a systematic process to assure that the survey was thorough and no paint waste was overlooked. Indeed, Ford had one clear objective for the paint waste investigation and removal activities: achieve a high level of scientific confidence that all paint waste material (e.g., paint residue, paint sludge, paint waste) is identified and removed, no matter how large or small a volume was encountered.

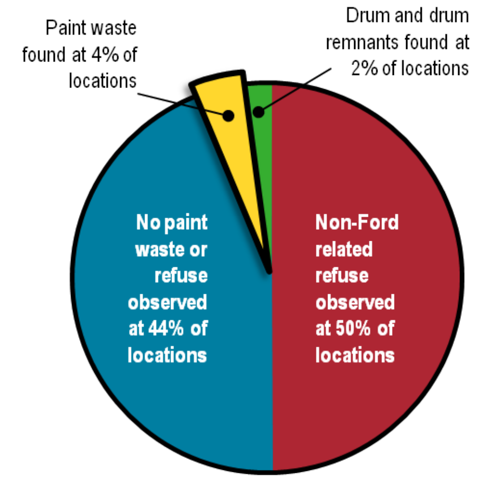
The survey areas were divided based on natural or human-made boundaries and site features into several smaller areas, or units, and given a unique number to aid in management of collected data. Survey lines were established every 50 feet across these units with individual survey points, or nodes, placed every 25 feet along the survey lines. The survey lines and nodes were mapped and the coordinates recorded and downloaded to portable GPS (Global Positioning System) units so survey crews would have accurate information about their location relative to the survey lines and nodes.

Crews of two people trained to recognize suspect terrain such as hummocky ground, fill piles or depressions, paint waste, drums, drum remnants, and soil conditions indicative of waste fill materials walked each survey line (total of 17 miles), recording their observations as they walked from one node to the next and collecting detailed information at each node. Crews investigated conditions 1 to 2 ft bgs at each node by collecting soil samples with a stainless steel probe. If the probe could not be advanced because of some obstruction, several additional attempts were made immediately around the node. The probe was also advanced in three to five additional locations within a 25-foot radius of each node to provide additional information about subsurface conditions.

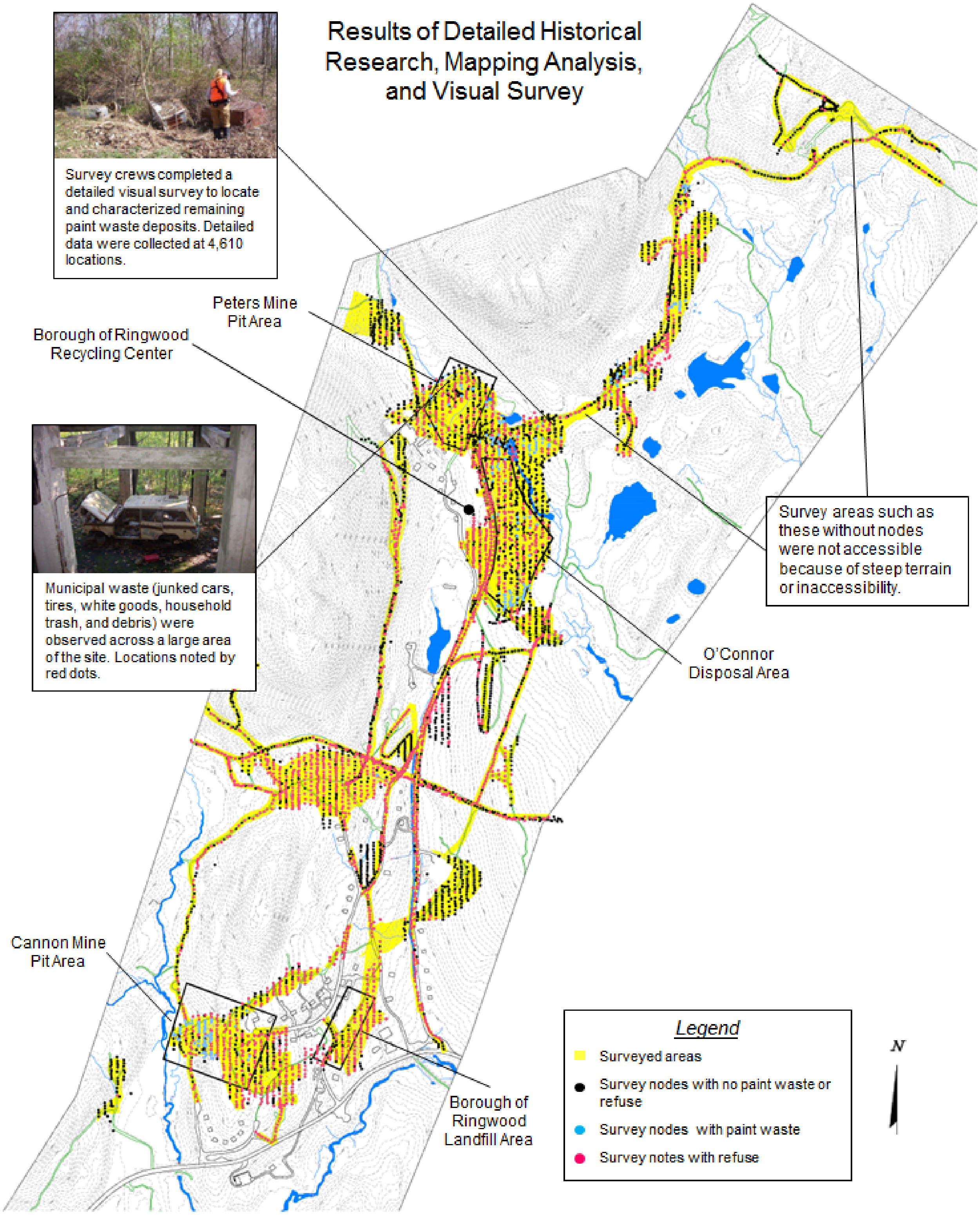
Crews recorded these observations in field log books, and the confirmed observations of paint waste, drums, or refuse at the nodes or along the survey lines were recorded using the GPS. Information gathered during the survey was reviewed frequently to verify its quality and whether it was sufficient to achieve the objectives of the survey. If there were questions about the recorded information as to its integrity, usability, or conclusiveness, crews returned to survey nodes to collect additional information.

Results of the Visual Survey Reconnaissance

Approximately 20 percent (97 acres) of the site had the potential to be disposal areas used by O'Connor based on historical records and physical characteristics (e.g., proximity to roads, topography, and other characteristics). These areas were surveyed with the field crews walking and observing conditions along 17 miles of survey line and collecting detailed data at 4,610 survey nodes. Of the 4,610 nodes surveyed, paint waste was found at 4 percent of the nodes; 96 percent of locations had no evidence of paint waste. Drum or drum remnants were observed in 2% of survey nodes and many of the nodes that had drums or drum waste also had paint waste. More than 50 percent of the survey nodes had evidence of non-Ford-related waste, such as junked automobiles, tires, construction materials, municipal refuse, and U.S. Government mine waste/tailings (ARCADIS, 2005). Nodes with paint waste in proximity to each other were grouped together and designated as removal areas. The figure on the following page summarizes the results.



Crews completed detailed evaluations at 4,610 survey nodes along 17 miles of survey lines. Paint waste was found at just 4% of all locations and voluntarily removed and disposed of off-site.


Results of Detailed Historical Research, Mapping Analysis, and Visual Survey
Survey crews completed a detailed visual survey to locate and characterized remaining paint waste deposits. Detailed data were collected at 4,610 locations.
Peters Mine Pit Area
Borough of Ringwood Recycling Center
Municipal waste (junked cars, tires, white goods, household trash, and debris) were observed across a large area of the site. Locations noted by red dots.
Survey areas such as these without nodes were not accessible because of steep terrain or inaccessibility.
O'Connor Disposal Area
Cannon Mine Pit Area
Borough of Ringwood Landfill Area
Legend
Surveyed areas
Survey nodes with no paint waste or refuse
Survey nodes with paint waste
Survey notes with refuse
N

Test Pit Investigation

Ford worked with NJDEP and USEPA to select areas for additional investigation based on evidence of potential anomalies noted during the survey, topographic evidence of potential fill areas, and information received from residents or other sources regarding potential disposal areas. As described in the *Report on Supplemental Investigation of Non-Residential Areas at the Ringwood Site* (ARCADIS, 2008a), a total of 79 such areas were selected for completion of test pits to investigate potential paint waste deposits. Similar to the visual survey, the test pit excavation teams were trained to recognize paint waste, drums, drum remnants, and soil conditions indicative of waste materials; and all test pit locations were mapped using GPS. Test pits were completed to a depth that either fully penetrated the fill material, or encountered native soils, continuous mine tails, bedrock, the water table, or the maximum reach of the excavating equipment. Crews inspected the fill material and debris removed from the test pits for paint waste (chips, fragments, or chunks) or drum remnants.

Paint waste was found in 2 of the 79 test pits, and drum remnants were not discovered in any of the test pits (ARCADIS, 2008a). Like the other areas identified during the visual survey, these two areas were designated as requiring removal. Crews made similar observations about the prevalence of other non-Ford-related materials as those noted in the visual survey; 57 percent of the test pits contained some type of trash, debris, municipal, or household waste (some of that waste extended 15 ft bgs).

Supplemental Investigation in Primary Disposal Areas

Focused supplemental investigation activities were completed in the historical primary disposal areas, which are the PMP Area, CMP Area, and the OCDA. These supplemental activities included completion of test pits, advancement of soil borings, sampling of various media (soil, groundwater, surface water), and survey work to characterize the geology. This investigation work helped establish the spatial extent of these three primary disposal areas, as well as the limits of paint waste confined within the PMP Area and the OCDA; no paint waste was identified within the CMP Area.

Excavation and Offsite Disposal of Paint Waste

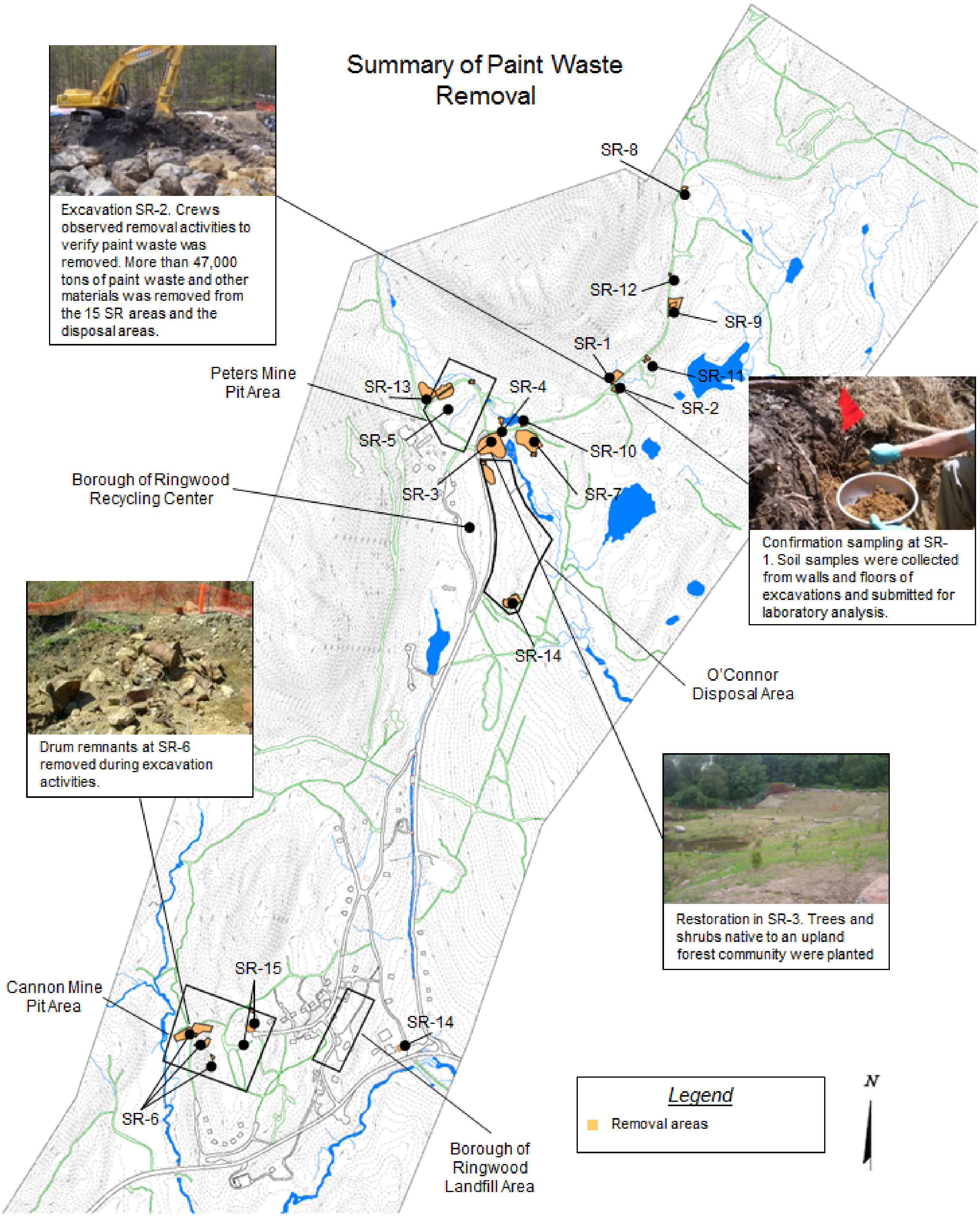
Armed with a comprehensive database of information on the locations of paint waste, Ford worked under the oversight of USEPA to remove paint waste from 15 areas (13 identified in the visual survey and 2 residential areas identified by USEPA). In addition, targeted removal activities were conducted within fill materials in the PMP Area and the OCDA to removal visually identified paint waste from these areas.

Using procedures established in the *Paint Sludge and Drum Removal Work Plan* (ARCADIS, 2004), Ford and its contractors conducted removal operations, under USEPA oversight and approval, from 2004 through 2012 in the areas where paint waste deposits were observed. Prior to backfilling the excavations, field crews examined the excavations to verify that all paint waste was removed and collected confirmatory soil samples for laboratory analysis. Soil samples were collected from the walls and the floors of the excavations following rules for confirmation sampling set by NJDEP and were submitted to a NJDEP-certified laboratory for analysis of VOCs, SVOCs, metals, and PCBs. Once analytical results confirmed that the concentrations of these constituents were within NJDEP standards, Ford and its contractors requested USEPA approval to backfill the excavations. All the data and activities are documented in a series of completion reports prepared to summarize results of the removal actions (ARCADIS, 2006a, 2006b, 2007a, 2007b, 2007c, 2008b, 2008e, 2010a, 2010b, 2010c, 2012, 2013a, 2013b).

After USEPA approval, the excavations were backfilled with clean soil brought from an offsite source and restored through planting of native species and restoration of habitat. The table below and the figure on the following page summarize the removal activities.

Paint Waste Removal and Confirmation Sampling Summary

Area	Location	Date of Removal	Volume Removed (tons)	Number of Confirmation Samples
SR-1/SR-2	Low-lying areas immediately west and east of the edge of Hope Mountain Road	January to June 2005	3,589	SR-1: 10 sidewall, 6 bottom SR-2: 9 sidewall, 8 bottom
SR-3	Northernmost portion of the OCDA in a low-lying area immediately east of Peters Mine Road	November to December 2005; January to March 2010	12,473	22 sidewall 35 bottom
SR-4	West of SR-3 in a low-lying area adjacent to the PMP and Park Brook	February 2006 and February 2010	1,474	12 sidewall 11 bottom
SR-5	North of the access road surrounding the PMP area	January 2011	Included with PMP Area	None collected; this area is part of the PMP Area.
SR-6	West of Van Dunk Lane at the top and on the side of a steeply wooded hill located northwest of the CMP Area	October 2007 to April 2008; March 2011	10,000 120	23 sidewall 69 bottom; 4 sidewall 3 bottom
SR-7	Low-lying area immediately east of Hope Mountain Road	April 2006 to January 2007; January to March 2010	10,950	39 samples
SR-8	Along Hope Mountain Road, approximately 2 miles north of PMP	March to June 2006	475	7 sidewall 8 bottom
SR-9	Along Hope Mountain Road, approximately ½ mile north of PMP	March to February 2007	3,000	25 sidewall 18 bottom
SR-10	Along Hope Mountain Road, approximately 400 feet north of PMP	March to July 2007	825	10 sidewall 8 bottom
SR-11	Along Hope Mountain Road, approximately ½ mile north of PMP	March to May 2007	900	13 sidewall 10 bottom
SR-12	Near utility pole along Hope Mountain Road between SR-9 and SR-8	June 2007	1.5	2 bottom
SR-13	Northwest and adjacent to the PMP Area	April 2011 to March 2012	3,350	34 sidewall 15 bottom
SR-14	Adjacent to the Ringwood Department of Public Works Garage on Margaret King Avenue	September to October 2012	150	4 sidewall 4 bottom
SR-15	Borough of Ringwood property along southwestern boundary with 38 Van Dunk Lane	October 2012	350	14 sidewall 7 bottom
PMP Area	See figure on page 12	January to February 2011	400	None collected
OCDA	See figure on page 12	January to April 2011	2,100	None collected


Summary of Paint Waste Removal
Excavation SR-2. Crews observed removal activities to verify paint waste was removed. More than 47,000 tons of paint waste and other materials was removed from the 15 SR areas and the disposal areas.
SR-8
SR-12
SR-9
SR-1
SR-11
SR-2
Peters Mine Pit Area
SR-13
SR-4
SR-5
SR-10
Borough of Ringwood Recycling Center
SR-3
SR-7
Confirmation sampling at SR-1. Soil samples were collected from walls and floors of excavations and submitted for laboratory analysis.
SR-14
O'Connor Disposal Area
Drum remnants at SR-6 removed during excavation activities.
Restoration in SR-3. Trees and shrubs native to an upland forest community were planted
SR-15
Cannon Mine Pit Area
SR-14
SR-6
Borough of Ringwood Landfill Area
Legend
Removal areas
N

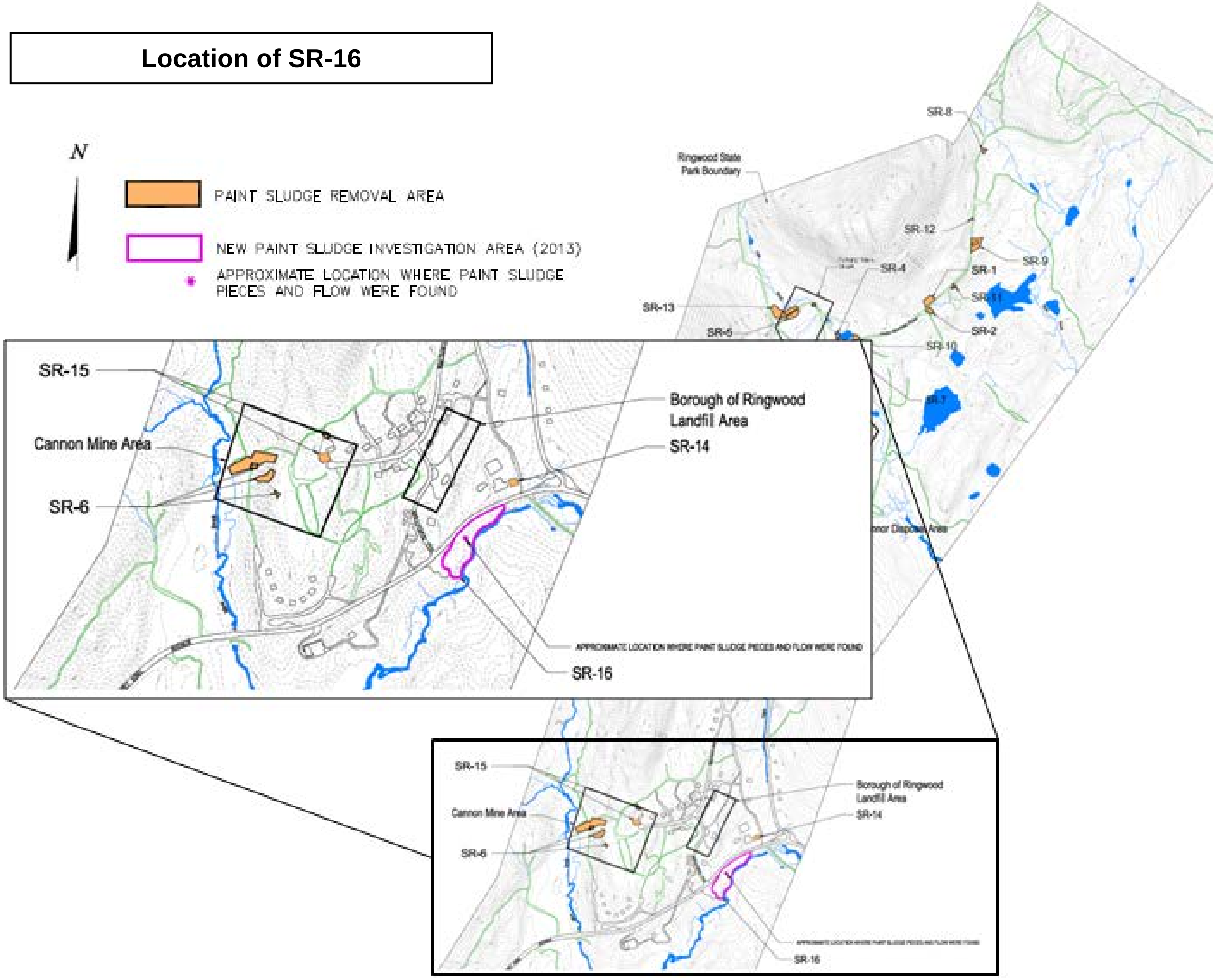
Summary and Next Steps

The identification and removal of paint waste from the Ringwood Mines/Landfill Site has been both systematic and thorough, resulting in the removal and offsite disposal of more than 47,000 tons of paint waste, impacted soil, and other waste materials between 2004 and 2012. The multi-step survey and investigation to identify locations known or suspected to have served as paint waste disposal areas included review of historical records, aerial maps, and topographic maps; gathering input from USEPA, NJDEP, local government officials, the community, and other groups; and systematically surveying potential disposal areas to make observations and collect data to characterize and precisely locate paint waste deposits.

Paint waste was observed at just 4 percent of the 4,610 locations set up along 17 miles of survey lines. Crews stopped at each of the 4,610 locations to record detailed information, and to collect and examine soil samples from the subsurface in search of potential paint waste deposits. Further, paint waste was observed in only 2 of the 79 test pit locations excavated to investigate areas suspected as possible paint waste disposal areas. Crews also completed supplemental investigation activities in the three primary disposal areas (PMP Area, CMP Area, and OCDA) to define the extent of paint waste in those areas.

As voluntary remedial measures conducted by Ford, the removal actions had one clear objective: achieve a high level of scientific confidence that all paint waste outside the three primary disposal areas is identified and removed, no matter how large or small a volume encountered. Ford and its contractors worked under the oversight of USEPA to complete paint waste removal activities in all areas outside the three Areas of Concern where paint waste was observed during the survey. In addition, subsequent targeted removal actions conducted within the PMP Area and the OCDA removed approximately 2,500 tons of paint waste from these areas. Crews visually verified that all paint waste was removed from identified areas and disposed offsite, and also collected soil samples for laboratory analysis to verify that concentrations of constituents of concern were within applicable NJDEP standards. Following excavation, removal areas were backfilled and restored to native habitat.

Ford is currently working with USEPA to develop a work plan to investigate and remove a paint waste deposit located south of Margaret King Avenue referred to as SR-16 (location shown in figure on the following page). SR-16 and the rest of the portion of the site south of Margaret King Avenue will be investigated using the same step-wise process used in previous investigations. Historical research will be conducted to identify areas that may have been used for disposal of paint waste. These areas will then be subject to a detailed field survey to identify paint waste deposits. The SR-16 deposit and any additional paint waste deposits identified during the survey will be removed using the same techniques successfully used to date.



Ford remains committed to addressing all paint waste deposits in the event that more are identified in the future, and Ford has in the past and will continue to work with USEPA to solicit information from stakeholders and others to identify suspected paint waste deposits. Should suspected paint waste be found outside the primary disposal areas, Ford will assess and remove the paint waste, as it is doing now at a location recently identified south of Margaret King Avenue. Ford does this work voluntarily as an active environmental steward of the site, but this ongoing commitment will also be documented in the Record of Decision.

References

ARCADIS. 2004. Paint Sludge and Drum Remnant Removal Work Plan. Ringwood Mines/Landfill Site. Ringwood, New Jersey. Prepared for the Ford Motor Company. December 14.

ARCADIS. 2005. Results of the Field Reconnaissance Survey of the Ringwood Mines/Landfill Site. Ringwood, New Jersey. Prepared for the Ford Motor Company. October 3.

ARCADIS. 2006a. Sludge Removal Area 8 (SR-8). Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. September 27.

ARCADIS. 2006b. Sludge Removal Area 1 and 2 (SR-1 and SR-2) Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. October 13.

ARCADIS. 2007a. Sludge Removal Area 9 (SR-9). Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. April 13.

ARCADIS. 2007b. Sludge Removal Area 11 (SR-11). Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. June 18.

ARCADIS. 2007c. Sludge Removal of Area 9 West Area (SR-9). Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. September 19.

ARCADIS. 2008a. Report on Supplemental Investigation of Non-Residential Areas at the Ringwood Site. January 22.

ARCADIS. 2008b. Sludge Removal Area 10 (SR-10). Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. April 10.

ARCADIS. 2008c. Draft Report on Investigation of Mine Tailings and Background Soils, Ringwood Mines/Landfill Site, Ringwood, New Jersey. June 6.

ARCADIS. 2008d. Statistical Sata Evaluation of Mine Tailings/Background Soil Investigation, Ringwood Mines/Landfill Superfund Site, Ringwood, New Jersey. December 8.

ARCADIS. 2008e. Sludge Removal Area 6 (SR-6). Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. June 18.

ARCADIS. 2010a. Request to Backfill and Restore Mine Tailings Removal Area SR-4. Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. March 30.

ARCADIS. 2010b. Request to Backfill Mine Tailings Removal Area SR-3. Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. March 31.

ARCADIS. 2010c. Mine Tailings Removal Area SR-7. Ringwood Mines/Landfill Site, Ringwood, New Jersey. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. April 1.

ARCADIS. 2012. Request for Completion of Excavation Activities within SR-13. Ringwood Mines/Landfill Site. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. September 19.

ARCADIS. 2013a. Ringwood Mines/Landfill Site. Request for Completion of Excavation Activities within SR-15. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. January 22.

ARCADIS. 2013b. Ringwood Mines/Landfill Site. Revised Request for Completion of Excavation Activities within SR-14. Letter addressed to Joseph A. Gowers, Project Manager, Southern New Jersey Remediation Section, USEPA Region II. March 7.